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PLATE I.



Callous tortuous stricture of the deep urethra.

# STRICTURE

OF

## THE URETHRA

BY

*G.* FRANK LYDSTON, M.D.

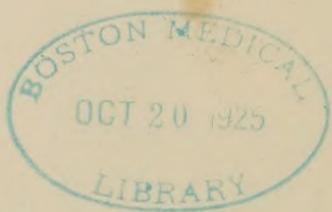
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ICAL ASSOCIATION, ETC.

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WITH SEVEN FULL PAGE PLATES AND EIGHTY-FIVE WOOD CUTS.

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CHICAGO:  
THE W. T. KEENER COMPANY  
96 WASHINGTON STREET  
1893



17. N. 3

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TO THE MEMORY OF

WILLIAM H. VAN BUREN, A.M., M.D., L.L.D.

FORMERLY PROFESSOR OF SURGERY IN THE BELLEVUE HOSPITAL  
MEDICAL COLLEGE, SURGEON TO CHARITY HOSPITAL,  
ONE OF THE PIONEERS IN GENITO-URIN-  
ARY SURGERY IN AMERICA,

THIS VOLUME

IS RESPECTFULLY DEDICATED BY HIS GRATEFUL PUPIL  
AND HOSPITAL INTERNE,

THE AUTHOR.

17 At. 3.

## PREFACE.

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This volume comprises essentially a series of class-room lectures upon urethral stricture. No attempt has been made to fill the work with rubbish from the literary dead lumber room, or to introduce innovations, more startling and misguiding than practical. The genito-urinary specialist, or to use a more modern term, the andrologist, may find that a great deal of old straw has been threshed over, but the general practitioner and student—for whom the book is especially designed—may find a few grains of practicality not hitherto presented in a readily assimilable form. Regarding the illustrations in this monograph, a fashion prevailing in certain quarters has been departed from, due credit being given, as far as possible, to the authors from whom they have been taken. Whether or not there is room for this addition to an already over-burdened special surgical literature, remains to be answered in the future by the publishers.

Opera House Block.

Chicago, May 1st, 1893.



## TABLE OF CONTENTS.

	PAGE
CHAPTER I.	
Anatomy of the Urethra.....	3-26
CHAPTER II.	
Normal curve of the Urethra. Instrumentation of the Urethra .....	27-47
CHAPTER III.	
Stricture of the Urethra. Definition and Varieties. Spasmodic, Congestive and Inflammatory Stricture.	48-71
CHAPTER IV.	
Organic Stricture. Traumatic Stricture. Urethral Stricture in the Female. Congenital Stricture. Varieties of Organic Stricture. Location of Strict- ure.....	72-89
CHAPTER V.	
Pathological Localization of Stricture.....	90-100
CHAPTER VI.	
Morbid Anatomy of Stricture.....	102-109
CHAPTER VII.	
Causes of Stricture. Symptoms of Stricture. Diagno- sis of Stricture. Prognosis of Stricture .....	110-133
CHAPTER VIII.	
Treatment of Stricture. General Management. Selec- tion of Method. Treatment by Caustics. Treat- ment of Stricture of the Meatus. Treatment of Stricture of the Penile Urethra. Treatment of Stricture of the Deep Urethra.....	135-163

## CONTENTS.

VIII

## CHAPTER IX.

- Systematic Treatment of Stricture by Dilatation..... 165-179

## CHAPTER X.

- Untoward Effects of Dilatation. Urethral or Urine  
Fever. Nervous Manifestations Following Dilat-  
ation. Hemorrhages and False Passages from  
Dilatation..... 180-212

## CHAPTER XI.

- Operative Treatment of Stricture. Divulsion. Inter-  
Urethrotomy. Cases Showing Permanency of re-  
sults in Urethrotomy. External Urethrotomy  
Subcutaneous Urethrotomy..... 213-260

## CHAPTER XII.

- Electrolysis of Urethral Stricture..... 261-275

## CHAPTER XIII.

- Complications and Secondary Results of Stricture.  
False Passages. Retention of Urine. Infiltration  
of Urine. Urethral Fistula. Prostatic Hypertro-  
phy. Inflammation of the Seminal Vesicles. Cys-  
titis. Impotence..... 276-327

## LIST OF ILLUSTRATIONS.

### PLATES.

PLATE I.—Callous tortuous stricture of the deep urethra. Frontispiece. ....	
PLATE II.—Multiple stricture.....	Facing page 72
PLATE III.—Old stricture of pendulous urethra, showing diverticula and bands .....	
PLATE IV.—Extremely contracted stricture in a young patient....	Facing page 109
PLATE V.—Granular Urethritis.....	Facing page 179
PLATE VI.—Formation of false passage in stricture.....	Facing page 276
PLATE VII.—Results of peri urethral suppuration with pocket and sinus formation.....	Facing page 304

	PAGE.
FIG. 1.—Anatomical relations of the urethra, prostate, and bladder, shown in vertical section. This illustration shows the relative curve of the urethra in its flaccid condition and in the position proper for instrumentation. (After Gray.) .....	5
FIG. 2.—Anatomical divisions of the urethra and their relations to Cowper's glands, the prostate and bladder.—(After Gray). ....	7
FIG. 3.—Section through spongy urethra, showing erectile tissue and relation of urethra to body of penis.—(After Cruveilhier). ....	9
Sections of the penis illustrating the relations of the urethra to the corpus spongiosum at various points from the glans to the bulbomembranous junction.—(After Weir). ....	10
FIG. 4.—Section made m. 0.010 below base of glans.....	10
FIG. 5.— " " m. 0.035 " " .....	10
FIG. 6.— " " m. 0.065 " " .....	10
FIG. 7. } Sections made from anterior boundary of bulbous portion almost to FIG. 8. } beginning of prostatic urethra .....	10
FIG. 9. } .....	10
a. b.—Vertical sections of spongy body showing relations of the urethra to the erectile tissue .....	10
FIG. 10.—Vertical section of the urethra at the fossa navicularis.—(After Cruveilhier) .....	11
FIG. 11.—Section through prostatic urethra.—(After Cruveilhier). ....	13
FIG. 12.—Showing lacuna magna. A. Spongy Urethra. B. Fossa Navicularis. C. Probe separating valve-like fold from roof of Lacuna Magna. D. Lacuna Magna.—(After Bumstead and Taylor) .....	15
FIG. 13.—Showing deep layer of superficial fascia (Buck's fascia) —(After Gray). ....	18
FIG. 14.—Buck's fascia reflected, showing structures within its layers.....	19
FIG. 15.—Buck's fascia, showing body of penis dissected up, exposing cavity comprised by the fascia.—(After Gurdon Buck).....	20
FIG. 16.—Showing deep perineal fascia (Triangular ligament), with its anterior layer removed.—(After Gray).....	22
FIG. 17.—Diagrammatic section of perineum showing arrangement of the triangular ligament (deep perineal fascia).—(After Tillaux).....	23
FIG. 18.—Deep dissection of perineum showing rectum turned aside and relations of prostate, seminal vesicles, bulb and membranous urethra.—(After Gray) .....	24

## LIST OF ILLUSTRATIONS.

FIG. 19.—Showing relations of bulb, membranous urethra and prostate to the deep perineal fascia or triangular ligament.—(After Gray).....	26
FIG. 20.—Showing proper curve for urethral instruments.....	28
FIG. 21.—Showing comparative curves of urethral instruments.....	29
FIGS. 22 and 23.—Scale plates for measuring instruments.....	38
FIG. 24.—Showing proper angle of point of instruments in relation to shaft.....	39
FIGS. 25 to 30.—Showing method of urethral instrumentation .....	42-45
FIGS. 31, 32 and 33.—Showing relation of the bougie a boule to points of contraction.....	46
FIG. 34.—Linear stricture in the anterior urethra.—(After Voillemier).....	77
FIG. 35.—Irregular stricture showing flaps, bands and bridles.—(After Dittel).....	78
FIG. 36.—Annular stricture.—(After Dittel).....	79
FIG. 37.—Case of multiple stricture.—(After Otis).....	81
FIGS. 38 and 39.—Casts of the urethra.—(After Sands).....	94
FIG. 40.—Extreme results of organic stricture.—(After Keyes).....	105
FIG. 41.—Results of urinary obstruction of long standing.—(After Crosse).....	106
FIG. 42.—Hypertrophy and contraction of the bladder from stricture.....	106
FIG. 43.—Extreme results of long standing stricture.—(After Morris).....	107
“ 44.—Otis' urethameter.....	120
FIGS. 45 and 46.—Bulb sounds and their modus operandi.....	121
FIG. 47.—Weiss' bougie a boule.....	122
“ 48.—Guyon's bougie a boule.....	122
“ 49.—Piffard's meatometer.....	123
“ 50.—Civiale's meatatome.....	123
“ 51.—Piffard's meatatome.....	123
“ 52.—Screw tipped guides.....	166
“ 53.—Gouley's whalebone guides.....	166
“ 54.—Banks' whalebone bougies.....	167
“ 55.—French olivary bougies.....	168
“ 56.—Van Buren's steel sound.....	169
“ 57.—Otis' endoscopic tube.....	177
“ 58.—Brown's urethral speculum.....	177
“ 59.—Klotz's endoscope.....	177
“ 60.—Weir's meatoscope.....	177
“ 61.—Method of injection of deep urethra.—(After Finger).....	178
“ 62.—Holt's divulsor.....	214
“ 63.—Thompson's divulsor.....	214
“ 64.—Gouley's rapid dilator.....	215
“ 65.—Gouley's dilating urethrotome .....	218
“ 66.—Maisonneuve's urethrotome .....	218
“ 67.—Civiale's urethrotome.....	219
“ 68.—Otis' straight urethrotome .....	219
“ 69.—Otis' curved urethrotome.....	220
“ 70.—Otis' diagonal urethrotome.....	225
“ 71.—Case showing remote result of internal urethrotomy.....	243
“ 72.—Wheelhouse's operation of perineal section.....	252
“ 73.—Method of using electrolysis in stricture —(Prince).....	264
“ 74.—Potain's aspirator.....	282
“ 75.—Showing proper points for rectal and suprapubic puncture.—(After Erichsen).....	283
FIG. 76.—Cock's operation of tapping the prostate.....	285
“ 77.—Extensive fistulae from stricture.....	307
FIGS. 78 to 81.—Szymanowski's operation for urethral fistula.....	316
“ 82 to 83.—Nelaton's operation for penile fistula.....	319
“ 84 to 85.—Clark's operation for penile fistula.....	319

# CHAPTER I.

## ANATOMY OF THE URETHRA.

A knowledge of the anatomy of the male urethra is of the greatest importance with reference to the study and treatment of urethral stricture, its results and complications, hence it may not be unprofitable to review it as a preliminary to the consideration of the latter subject.

The male urethra, unlike that of the female, subserves two important functions: that of urination, which function the urethra of the male and female possess in common, and that of generation, which is peculiar to the male canal. As far as its urinary function is concerned, the urethra is of secondary importance, inasmuch as it is by no means necessary to micturition; it is, however, of the utmost importance as a carrier of semen. Upon the deposition of the semen at the proper point in the vagina, impregnation chiefly depends,—as far as the seminal elements are concerned. Obviously, the conveyance of the semen to the proper point depends upon the functional integrity of the urethra. In considering the diseases of the urethra and their direct and remote results, both the urinary and sexual functions of the canal should be taken into consideration.

The urethra extends from the anterior extremity of the glans penis to the neck of the bladder. In its quiescent and flaccid condition it presents two distinct curves, one of which corresponds to the pendulous portion of the canal and curves from about the situation of the triangular ligament, first upward and forward and then downward, with its concavity below, and the other representing the fixed portion directed from the triangular ligament first downward and then upward

with its concavity above. When in the erect state, the anterior curve is obliterated and the canal becomes straight from the meatus urinarius almost to the opening in the triangular ligament.

The length of the urethra as given by most anatomists is from eight to nine inches, but the greatest discrepancy exists upon this particular point. A table showing the estimates of various clinical observers would show an especially marked variance of opinion. A difference of twenty or thirty per cent in the estimated measurements of equally competent observers is not unusual, and is hardly to be wondered at. It is probable that no two observers can possibly obtain precisely similar conditions for measurement. The penis varies in size not only intrinsically in different subjects, but there is the greatest imaginable variation in the same subject under different conditions. Some patients undergo manipulations of the sexual organs with the greatest equanimity, while in others the organs are either reflexly excited or emotionally inhibited as to circulation. The result is a decidedly fluctuating standard of urethral measurement. Much depends upon the method of measurement. One surgeon will pull the organ tensely upward on the shaft of the instrument, while another will allow it to remain in its normal position; others again, will crowd the organ down towards the perineum with little or no attempt at support by traction or otherwise. The average length of the urethra as determined upon a series of cadavers, is obviously an unfair criterion for practical deductions, as there are none of the conditions present,—save of course, variations of manipulation,—which prevail during life. The length of time elapsing after death before the measurements are made, probably has much to do with the accuracy of the result.

From what has been said, it will be observed that each urethra is a law unto itself as far as its length is

concerned. The length of a particular urethra may be said to be the distance from the meatus traversed by the catheter before the urine begins to flow, the penis being flaccid and placed upon a degree of tension merely sufficient to afford adequate support during instrumentation. Due allowance should be made for sexual excitation or emotional inhibition.

The same arguments are pertinent with reference to the determination of the average calibre of the

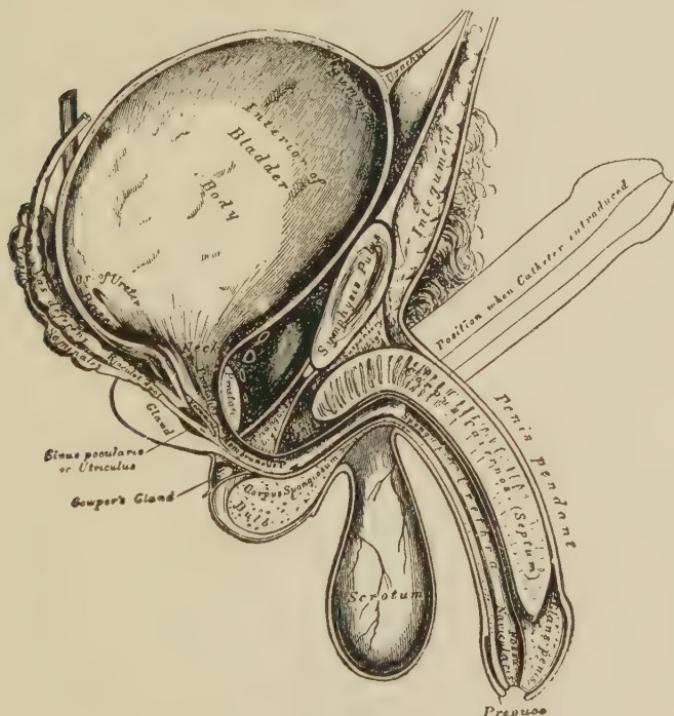


FIG. I.

Anatomical relations of the urethra, prostate, and bladder, shown in vertical section. This illustration shows the relative curve of the urethra in its flaccid condition and in the position proper for instrumentation. —(After Gray.)

urethra. This is a point too often neglected by the surgeon.

In discussing the anatomy of the urethra we must *nolens volens* accept the statement of Gray and others,

that the adult urethra averages from eight to nine inches in length.

The external curve of the urethra is not of great importance with relation to instrumentation, as it can be adapted to almost any form of instrument. It is different, however, with the posterior or deep curve which is relatively fixed; it cannot be said to be constantly fixed, because as is well known, straight instruments can be introduced into the bladder. The fixed urethral curve is not uniform, but varies widely with the period of life and the condition of the prostate body. It is comparatively short and sharp in the child, much longer and less abrupt in the adult, these characteristics increasing in prominence greatly as the subject grows older. In prostatic enlargements the curve becomes so greatly elongated as to necessitate considerable modification of instruments and manipulations for entering the bladder. This point is of the greatest practical importance to the genito-urinary surgeon.

#### DIVISIONS OF THE URETHRA.

The urethra is divided for description into the spongy, membranous and prostatic portions. Of these portions the spongy is about six inches, the membranous three-fourths of an inch, and the prostatic one inch and a quarter in length.

*Meatus urinarius:* The urethra begins in front at the meatus urinarius, an opening which varies greatly as regards its size and dilatability. The degree of dilatability depends mainly upon the consistency of the tissue at the inferior commissure of the meatus. In some cases this consists of a thin membranous septum which distends readily and admits a much larger instrument than would be supposed from the calibre of the meatus. In other cases, although this tissue is quite thin there appears to be when put upon the stretch, a tense fibrous cord about the meatal circumference which may be ob-

served as a thin white band which tightly grasps the instrument. Attempts at stretching this band only results in reflex resentment, so to speak, against the pas-

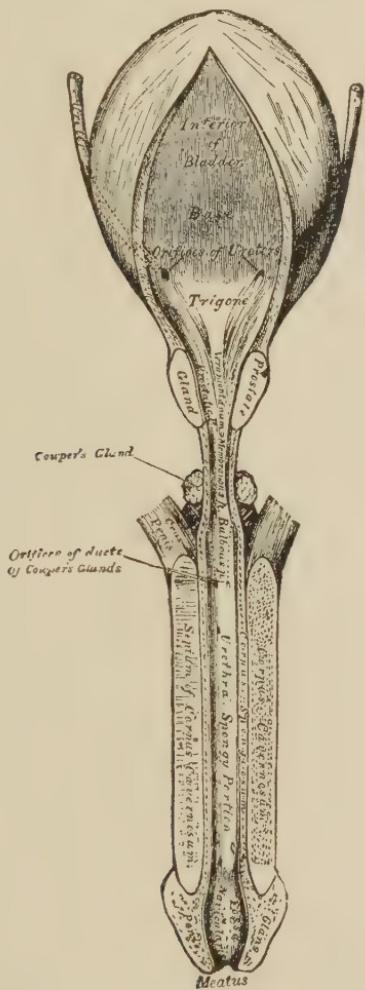


FIG. 2.

Anatomical divisions of the urethra and their relations to Cowper's glands, the prostate and bladder.—(After Gray.)

sage of the instrument by the urethral muscles. In some cases the lower commissure of the meatus is formed by a quite thick septum of spongy tissue, the

post-meatal pouch being almost absent. Obviously, it is in the latter variety of conformation that we experience most difficulty in meatotomy, from cicatricial contraction.

In quite a large proportion of cases the meatus is fairly dilatable but the urethra is contracted just within the orifice. This contraction constitutes a quite frequent form of congenital stricture of the meatus. In some cases this congenital narrowing is from one-fourth to one-half an inch from the external orifice. These points of narrowing should be taken into consideration in the performance of meatotomy. Very frequently the meatus is incised and the contraction which is causing the trouble for which the operation is indicated is completely overlooked, with a consequent failure to give relief to the symptoms. Occasional cases are seen in which the meatus is bifid below. Others again, present a fold of quasi-mucous membrane passing transversely across the superior angle of the meatus just within the commissure.

In certain cases of hypospadias the urethra opens on the under surface of the glans or at some point in the floor of the spongy urethra. In such cases the orifice is small and pouting, and is very easily irritated. When a gonorrhœa or stricture exists in such cases the situation is annoying in the extreme.

*Spongy Urethra:* The spongy, pendulous or penile urethra is the longest part of the canal and extends from the meatus urinarius to the triangular ligament. This portion of the urethra tunnels the corpus spongiosum. It is about six inches in length and begins posteriorly about an inch below the pubic symphysis, at which point it traverses the triangular ligament. In this situation the corpus spongiosum presents a bulbous expansion, the bulb of the corpus spongiosum,—the urethra being correspondingly dilated,—the bulbous urethra. This point of dilatation is to be remembered as the locality in which

chronic inflammation is most likely to become localized, a matter of the utmost importance in the consideration of chronic urethritis and stricture. A stricture of the deep urethra is quite apt to be associated with a chronic granular urethritis at this point. It is in this region also that pouching of the urethra is most apt to occur as a consequence of anterior obstruction or of bungling attempts at instrumentation of stricture located behind the bulb. According to Gray and others, the spongy urethra is of uniform size in the body of the penis, but while this may be true from the post mortem standpoint of the anatomist, it is rarely so from that of the clinician. Few urethrae, indeed, will be found in which the spongy urethra does not show a variation of calibre at different points. This variation may be relative and not real, and due to a variation of dilatability under pressure, but it is none the less a palpable condition under the hands of the practical surgeon.

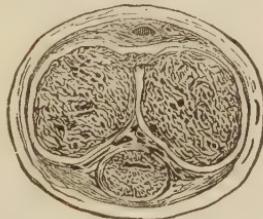


FIG. 3.

Section through spongy urethra showing erectile tissue and relation of urethra to body of penis.—(After Cruveilhier.)

Just at the point where the central portion of the spongy urethra begins to dilate to form the bulbous urethra, the urethra is relatively slightly narrowed,—or perhaps more properly speaking, relatively indistensible. The same holds true of the anterior extremity where the spongy urethra dilates to form its anterior expanded extremity, the fossa navicularis.

The bulbous urethra is the point of exit of the ducts of Cowper's glands, structures which occasionally afford an annoying complication of urethritis.

A cross section of the penis at different points shows considerable variation in the relation of the canal to the structures composing the penile tissues. A cross section of the glans shows the long diameter of the urethra to be from above downward, while posteriorly it is either transversely straight or transversely crescentic.

The following diagrammatic sections of the penis at different points illustrate this anatomical fact very nicely. These were prepared by one of our most conscientious and pains-taking American surgeons, Prof. R. F. Weir, of New York City.

FIG. 4.



FIG. 5.



FIG. 6.

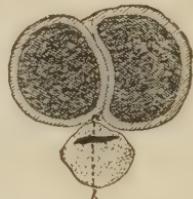


FIG. 7.

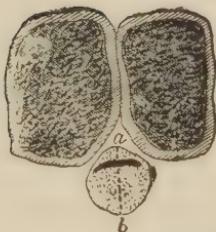


FIG. 8.

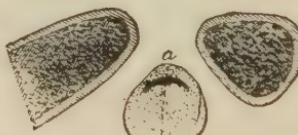


FIG. 9.



Sections of the penis illustrating the relations of the urethra to the corpus spongiosum at various points from the glans to the bulbo-membranous junction.—(After Weir.)

Fig. 4. Section made m. 0.010 below base of glans.

Fig. 5. " " m. 0.035 " " "

Fig. 6. " " m. 0.065 " " "

Fig. 7. } Sections made from anterior boundary of bulbous portion al-

Fig. 9. } most to beginning of prostatic urethra.

a. b. Vertical sections of spongy body showing relations of the urethra to the erectile tissue.

*Fossa navicularis:* The spongy urethra is considerably expanded just within the meatus, the expansion corresponding in extent to the glans penis and termi-

nating posteriorly by a slight contraction at its junction with the main portion of the spongy body.

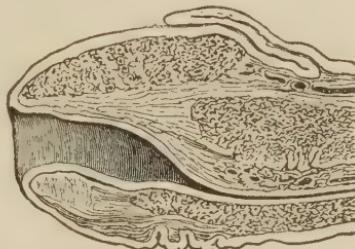


FIG. 10.

Vertical section of the urethra at the fossa navicularis.—(After Cruveilhier.)

In this portion of the urethra also there is a tendency to localization of inflammation. Very frequently a chronic gleet will depend entirely upon a chronic inflammation in the pouch-like cavity of the fossa navicularis just behind the inferior commissure of the meatus. Such cases are incurable until meatotomy has been performed, thus securing the necessary rest and drainage for the affected part.

*Membranous urethra:* The membranous urethra extends from the anterior layer of the triangular ligament, at which point it joins the bulb, to the apex of the prostate. With the exception of the meatus, it is the narrowest portion of the canal. It is necessary to state however that this relative narrowness is due to the fact that it is a muscular structure and is a veritable sphincter, being continuously in a state of tonic contraction. Although the narrowest part of the canal under normal circumstances, it is capable of more extreme dilatation than any other portion of the urethra, with the exception of the prostatic. According to P. Delbet it may be dilated to a diameter of 15 m. m. without rupturing, a degree of distention which could hardly be supported by the spongy portion.\*

\* P. Delbet, Recherches Anatomiques sur l'urethre. Annales des mal. des org. genito-ur. Mar. 1892.

Guyon has observed that in passing instruments of very large calibre, rupture of the urethra always occurs in the spongy portion.\*

On account of the strong and abundant muscular fibres by which it is surrounded, the membranous urethra has been termed the muscular region. This point is worthy of attention with reference to spasmodic obstruction to urination and the passage of instruments which so frequently occurs at this point.

The membranous urethra lies between the fibrous layers of the triangular ligament, and measures three-fourths of an inch in length upon the roof of the canal. Upon the floor, where it is encroached upon by the bulb of the corpus spongiosum, it is reduced to one-half an inch in length.

The point at which the membranous urethra enters the triangular ligament is situated about one inch below the pubic symphysis, the dorsal vein of the penis piercing the ligament one-fourth of an inch higher up. It is important to remember the relation of the membranous urethra to the pubic arch, especially in connection with the operation of perineal section.

The membranous urethra is composed of numerous muscular fibres and fibro-elastic tissue, with a thin layer of erectile tissue. It is surrounded by the compressor urethrae muscle, and is lined by mucous membrane which is closely applied to the sublying tissues, areolar tissue being very scanty.

*Prostatic Urethra:* The prostatic urethra is the largest portion of the urethra, and is also capable of more extreme dilatation than any other division of the canal. It is about an inch and a quarter in length, and tunnels the upper portion of the prostate body, coming so near the upper surface of the latter in some cases that the canal is barely covered in above by prostatic tissue. The prostatic urethra extends from the neck of the blad-

\*Guyon Op. cit.

der,—so called,—to the posterior layer of the triangular ligament where it joins the membranous portion. It is spindle-shaped, being widest in the middle and narrowest at its junction with the membranous portion. From before backward it is widest above, coming to a point below, this giving the canal a triangular form on transverse section.

The floor of the prostatic urethra presents for study the most important structures of any portion of the canal. Disease located in this region is not only apt to become extremely chronic and obstinate but may lead to very serious complications.

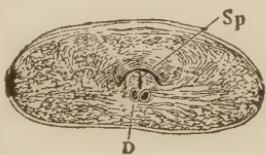


FIG. II.

Section through prostatic urethra. S. p. sinus prostaticus. D. ejaculatory ducts.—(After Cruveilhier.)

Upon the floor of the prostatic urethra is a longitudinal elevation from eight to ten lines in length, composed of erectile and muscular tissues.\* This is called the *veru montanum* or *caput-gallinaginis*, (cock's comb). The function of this structure is probably to distend during coitus, thereby preventing the backward passage of the semen during ejaculation, thus affording a counter-pressure which assists in the extrusion of the semen in the normal manner.

An interesting point bearing upon this function is related by French writers: Certain Parisian prostitutes are said to prevent conception by pressing upon the membranous urethra of their partners *via* the rectum at the moment of ejaculation, with the result of forcing the semen backwards past the *veru montanum* into the bladder. After frequent repetitions of this performance

\*Kobelt.

the function of this structure is said to be completely and permanently inhibited, with the result that the individual is ever after sterile and ejaculates his semen into his own bladder.

On each side of the *veru montanum* is a longitudinal depression, the prostatic sinus, upon the floor of which open the orifices of the ducts of the prostatic follicles, twenty or thirty in number. Just in front of the *veru montanum* in the median line is a depression, the *sinus pocularis*, otherwise known as the *uterus masculinus*, upon the supposition of its homology with the womb \* It contains the orifices of numerous small glands and upon its margins open the slit shaped apertures of the ejaculatory ducts.

*Glands of the Urethra:* The various glandular structures of the urethra are of some clinical importance. Scattered all along the canal and especially on the floor of the spongy portion are numerous glandular follicles, the function of which is to furnish mucus for the lubrication of the urethra. This lubricating action is of especial service during the ejaculation of semen. It is quite likely also that the mucus thus secreted is of value in diluting and increasing the bulk of the semen. It is also said that the alkalinity of this mucus is useful in neutralizing the acidity of the vaginal secretions which would otherwise be inimical to the vitality of the spermatozoa.

These mucous follicles are known as the glands of Littré. They open by ducts which directed toward the meatus and are known by some authors as the sinuses of Morgagni. According to others the true sinuses of Morgagni are blind ducts which run parallel with the mucous membrane for about half an inch, terminating in a *cul de sac*. Cruveilhier described these ducts or sinuses, and stated that he had seen one which was an inch in length. These ducts and sinuses become dilated

\*Weber.

in conditions of chronic inflammation, and have much to do with the perpetuation of gleet. It is my own opinion that the products of virulent inflammation may remain sealed up in the urethral follicles for an indefinite period, and by discharging from time to time, cause apparently fresh attacks of virulent urethritis. A single follicle thus distended may indefinitely prolong urethral trouble.

A point of equal if not greater importance regarding these follicles is that their ducts may catch the points of small instruments in the treatment of stricture. Such a lodgment of a fine instrument is often the starting

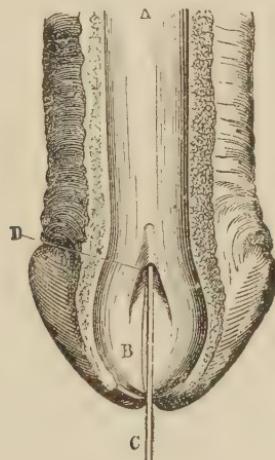


FIG. 12.

Showing lacuna magna. A. Spongy Urethra. B. Fossa Navicularis. C. Probe separating valve-like fold from roof of Lacuna Magna. D. Lacuna Magna.—(After Bumstead and Taylor.)

point of a false passage. Atrophy of the follicles and distention and tearing up of these ducts and sinuses often accounts for the formation of flaps, bands and bridles in stricture.

There is one sinus in the urethra that is of the utmost importance. This is quite large, and is located upon the roof of the fossa navicularis. It is known as the lacuna magna. Its floor is formed by a valvular

flap of mucous membrane. Instruments are frequently caught in this valvule, the obstruction being mistaken for stricture. The relation of this peculiar pouch to chronic inflammation has already been expatiated upon.

The sinus pocularis is also mentioned as a point at which instruments are apt to lodge. I suspect however that the importance of this has been overrated.

*Cowper's glands* are important accessories to the urethra. They are small round bodies lying just behind the bulb, one on either side, between the layers of the triangular ligament. They are lobulated in structure and furnish a fluid which is supposed to assist in diluting and increasing the bulk of the semen. These glands are of pathological importance in urethritis, as they are prone to infection with resultant acute inflammation and oftentimes abscess.

#### STRUCTURE OF THE URETHRA.

The urethra is composed of three coats—mucous, muscular and erectile. The mucous coat is a continuation of the general mucous membrane of the genito-urinary tract, and forms the lining of all the ducts opening into the urethra. This being the case, it is easy to understand the extension of infectious or other inflammatory processes to the urethral follicles, Cowper's glands, seminal vesicles and testes. The mucous membrane of the urethra is quite sensitive,—resembling the conjunctiva in this respect. It is of a light pinkish color in its normal condition but becomes darker and loses its gloss in conditions of inflammation. The epithelium of the urethral mucosa is of the pavement variety immediately behind the meatus, elsewhere it is of the columnar variety. The areolar tissue beneath the mucous membrane is very scanty. A peri-urethritis therefore means inflammation of the areolar and erectile tissue outside of the tube. The mucous coat of the urethra is

composed of two layers, an external longitudinal and internal circular. These fibres are of the involuntary variety and bear an important relation to stricture. They are interspersed with fibro-elastic and fibro-connective tissue. It is the relative proportion of the elastic and muscular to the inelastic tissues that determines the degree of dilatability of any particular point of the canal.

The erectile tissue is a relatively thin layer which has rather less fibrous tissue forming its trabeculae than have the corpora cavernosa. The varying amount of fibrous tissues in the erectile spaces also modifies the dilatability of the canal, and in conjunction with a variation in the relative proportion of elastic and inelastic tissue in the muscular walls, explains the varying calibre of the urethra, both in different subjects and in the same subject at different points.

There are some interesting points regarding the form of the urethra that deserve passing mention. The urethra is not a rigid and inflexible tube but unless distended with fluid or an instrument its walls are closely in contact. In the flaccid state, the mucous membrane is thrown into longitudinal folds. This point is of the utmost importance from a therapeutical standpoint, for no antiseptic or astringent application can be effective unless applied while the urethra is, so to speak, unfolded. The arrangement of these folds also facilitates the formation of stricture when once the deposition of plastic material has begun. It is probable that in the collapsed and retracted state of the penis, the urethra assumes a somewhat spiral or twisted form. Some ten years ago I called the attention of my classes to the fact that this rifling of the urethra imparts a distinct twist to the stream of water escaping from the meatus during irrigation of the canal. In some cases the stream will twist about the catheter in three or four distinct spirals. This occurs not only with the lateral-eyed catheter but also with the open ended variety. The fact has re-

cently been brought to my notice that an English surgeon a few years ago called attention to this rifling of the urethra.

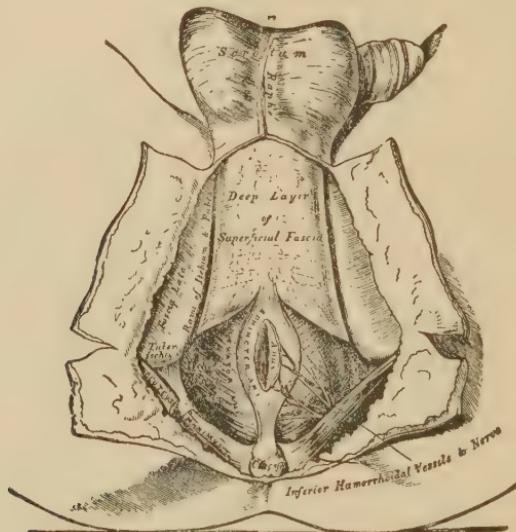


FIG. 13.

Showing deep layer of superficial fascia (Buck's fascia).—(After Gray.)

**BUCK'S FASCIA:** One of the most important structures for the consideration of the genito-urinary surgeon is the layer of fascia, first accurately described by Dr. Gurdon Buck of New York City. The division of the fascial investments of the body into special fasciæ is, as a rule, of questionable value, but an exception is certainly to be made in this case. Buck's fascia has become dignified by a special nomenclature by virtue of certain peculiar and specialized anatomical relations and attachments, that practically,—at least from a clinical standpoint,—differentiate it from the general layer of superficial fascia covering the body.

Fig. 13 shows this specialized fascia after removal of the skin, areolar tissue and superficial layer of the superficial fascia.

Buck's fascia is thin, aponeurotic in structure and quite strong. It begins above at the symphysis

pubis at the suspensory ligament of the penis, at which point, as shown by Richet, it is continuous with the general fascia of the abdomen. It passes downward over the penis and around the corpora cavernosa, beneath which it splits into two layers which pass downward and invest the spongy body. Anteriorly it is attached to the base of the glans penis. Passing backward after forming the true sheath of the penis, it be-

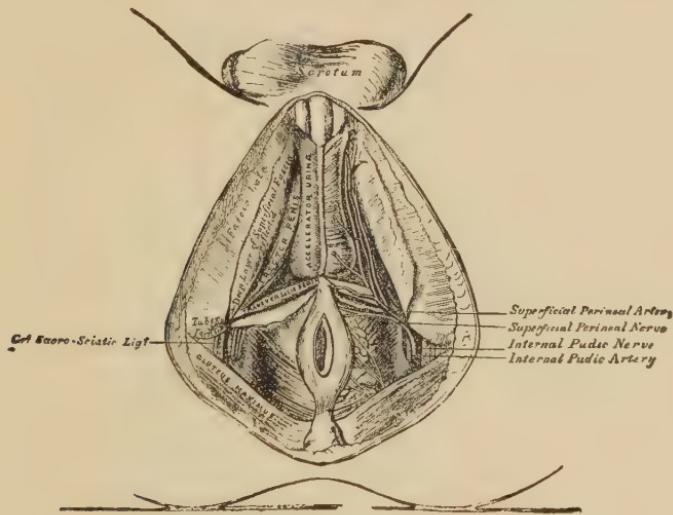


FIG. 14.

Buck's Fascia reflected, showing the structures within its layers.—  
(After Gray.)

comes continuous with the dartos muscle covering the testes, or better, at the point where it invests the testes, the fascia becomes muscular. Passing downward into the perineum, the fascia passes backward as far as the transversus perinei muscle, at which point it dips downward and becomes attached to the anterior layer of the triangular ligament. It is firmly attached laterally to the rami of the pubes and the ascending rami of the ischia as far back as the tuberosities.

As shown in Fig. 14, Buck's fascia covers in the urethral muscles, superficial perineal arteries, veins and nerve.

The peculiar and firm attachments of Buck's fascia explains the limitation of urinary and purulent extravasations into the perineum. The penis, scrotum and perineum may be infiltrated, but the thighs and the vicinity of the anus cannot possibly become so save by rupture of this fascia. This rarely occurs, yielding above at the pubic symphysis being more frequent. In the latter event the extravasated fluid burrows outward along the groins.

Fig. 15 shows very beautifully the manner in which this fascia invests the penis.

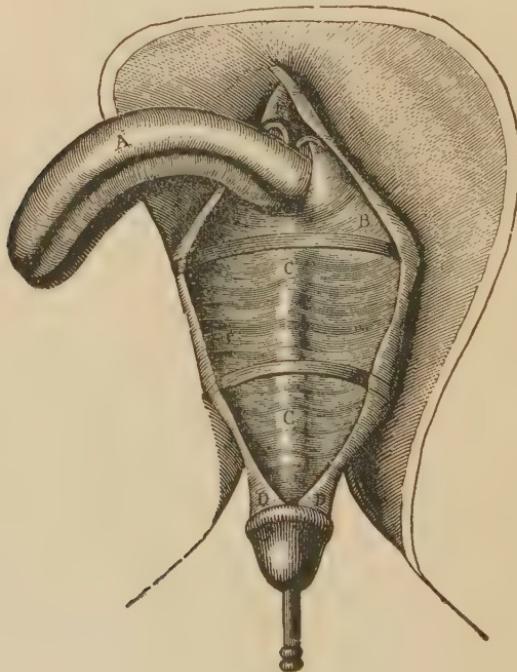


FIG. 15.

Buck's Fascia, showing body of penis dissected up, exposing cavity comprised by the fascia.—(After Gurdon Buck.)

MUSCLES OF THE URETHRA.—The muscles surrounding the urethra are of the greatest physiological and often of pathological importance. The special urethral muscle is the accelerator urinæ or compressor ure-

thræ. This consists of a layer of fibres, chiefly obliquely arranged, which surrounds the urethra from the prostate to the bulb, being relatively sparse in front but quite thick and numerous in the bulbo-membranous region. The function of this muscle is to act in conjunction with the longitudinal, circular and elastic fibres of the urethral walls in expelling the urine and semen. The last few drops of urine and semen are extruded by a continuous wave of contraction. If this vermicular wave of contraction be interfered with as in stricture, a portion of fluid is apt to be retained in the canal to dribble away at will as soon as the penis is allowed to assume the dependent position. These muscles also enter into the "cut off" function to be described.

It is probable that all the perineal muscles are concerned in the urinary and generative functions. The muscular tissue of the prostate body, the transversus perinei and even the levator ani act in conjunction with the urethral muscles proper, in expelling fluid and in cutting off the flow of urine at proper and improper times. These various muscles compose the group described by Cruveilhier as one muscle—the transverso-urethral or voluntary cut-off muscle. A peculiar physiological circumstance is involved in the action of this muscle. We cannot will all the elements of this muscle to contract, our volitional control consisting merely in our ability to relax the muscles of the sphincter proper from their normal condition of tonicity. In the case of the perineal group, however, we may bring about voluntary contraction and either expel fluid or assist in cutting off the flow of urine. The perineal muscles then, are merely auxiliary to the sphincter proper, which comprises the muscle of the prostate, the accelerator urinæ, a few circular fibres at the vesical neck, and the muscular walls of the membranous urethra. While the bladder is not functioning, the sphincter represented by these several muscles

is in a state of tonic contraction sufficient to resist the normal elasticity and tonicity of the detrusor urinæ or muscular wall of the bladder. By volitional effort we may inhibit the action of the muscles composing the sphincter vesicæ, when, the action of the detrusor urinæ coming into play, the urine is immediately expelled. Emotional excitement may interfere with our volitional control over this group of sphincteric fibres, and also inhibit the detrusor urinæ, with the result that urination becomes temporarily impossible. This is the explanation of the inability of the average man to urinate in the presence of others. This condition is not, as is uniformly claimed, one of spasm. Reflex or direct irritation may, however, cause spasmodic contraction of the entire group of perineal and urethral muscles with

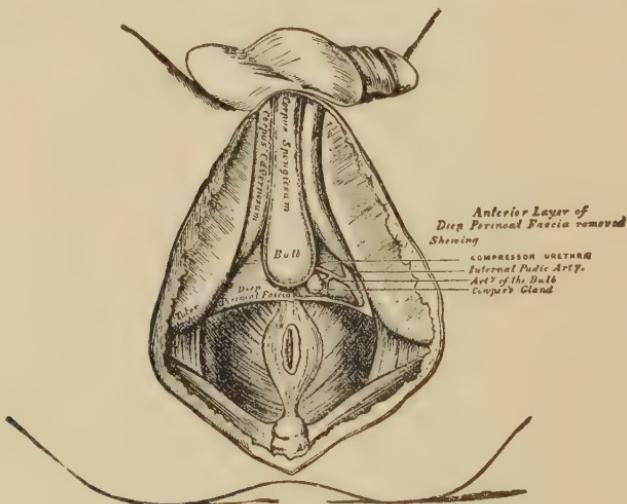


FIG. 16.

Showing deep perineal fascia (Triangular ligament), with its anterior layer removed.—(After Gray.)

resulting spasmodic stricture and perhaps complete and prolonged retention. This condition may be produced by irritation of any part that is associated with these muscles through the medium of a common or associated nerve supply. *Irritation is always necessary to the produc-*

*tion of spasmotic stricture: Emotional excitement never, in my opinion, produces it.*

TRIANGULAR LIGAMENT.—The deep perineal fascia or triangular ligament, so-called, bears a relation to the general deep fascia somewhat similar to that which exists between Buck's fascia and the general superficial fascia. It consists of a dense membranous septum from the deep fascia which closes in the anterior portion of the pelvic outlet. As its name implies it is of a triangular form. It is firmly attached above to the sub-pubic ligament and pubic symphysis, and laterally to the pubic and ischiatic rami. Its base is directed toward the rectum and becomes blended with Buck's fascia just behind the transversus perinei muscle.

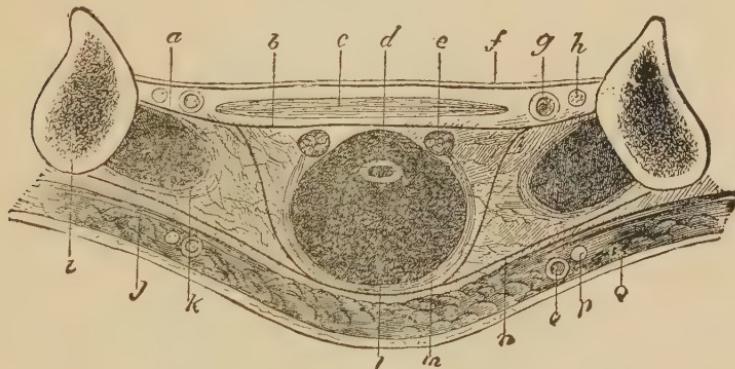


FIG. 17.

Diagrammatic section of perineum showing arrangement of the triangular ligament (deep perineal fascia). a. Corp. cavernosum. b. Inferior layer of triang. ligt. c. Transversus perinei muscle. d. Urethra. e. Cowper's glands. f. Superior layer of triang. ligt. g. Internal pudic artery. h. Interna. pudic nerve. i. Descending ramus of ischium. j. Superficial fascia. k. Erector penis muscle. l. Bulb. m. Accelerator urinae muscle. n. Superficial fascia. o. Superficial perineal artery. p. Superficial perineal nerve. q. Skin.—(After Tillaux.)

The triangular ligament is very important in its relations to the surgical anatomy of the perineum and urethra. It consists of two layers, an anterior and a posterior, forming, so to speak, a space which contains some very important structures. It is traversed by the membranous urethra, which begins about an inch below the pubic symphysis. One-fourth of an inch above it

is found the dorsal vein, artery and nerves of the penis, which are given off in the space enclosed by the triangular ligament, from the pudic artery and nerve. Within this space are also to be found the arteries of the bulb, and Cowper's glands, one upon either side. The triangular ligament is chiefly important because of the fact that it is in this region that deep stricture of the urethra is usually located. It is the opening of the urethra as it enters the triangular ligament that the surgeon seeks to outline and enter in perineal section without a guide.

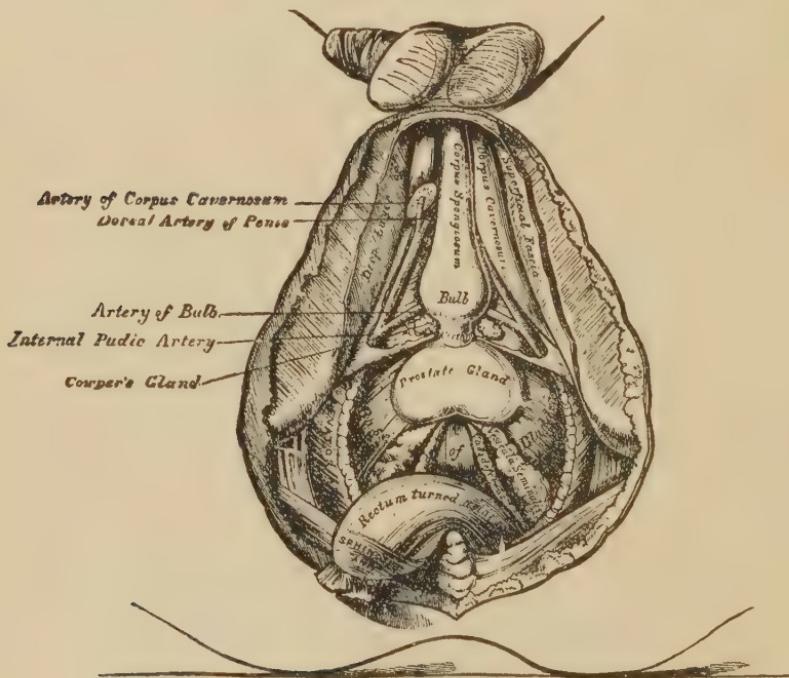


FIG. 18.

Deep dissection of perineum showing rectum turned aside and relations of prostate, seminal vesicles, bulb and membranous urethra.—(After Gray.)

The principal point to be remembered is the location of the urethra with reference to the pubic symphysis. By bearing this in mind the surgeon will not dissect at random into the pre-rectal space in a frantic effort to find

the urethra, a blunder that I have seen made on several occasions.

It is interesting to note that in injuries to the perineum the resulting traumatic stricture occurs in the membranous region. At this point the urethra is caught between the sharp lower border of the sub-pubic ligament and the impinging body. The sub-pubic ligament being sharp-edged and almost as hard as bone, the urethra is apt to be seriously injured even from comparatively slight blows; indeed, it requires but moderate force to sever it completely. The resulting stricture is the worst variety with which we have to deal.

A clear idea of the relations of the various parts in the perineum is quite essential to skillful surgery in

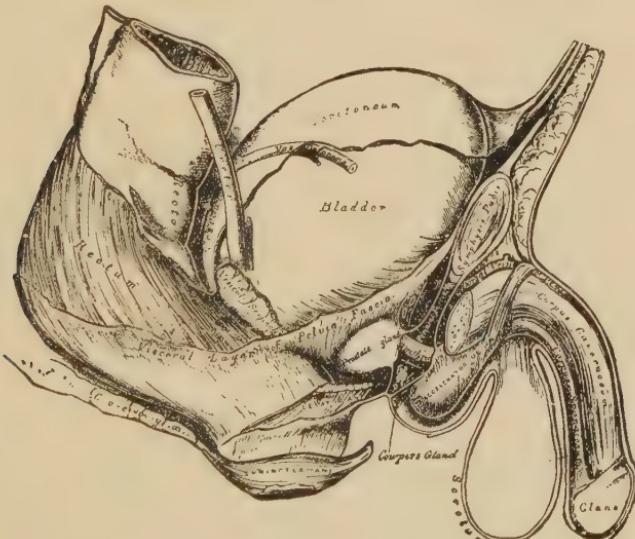


FIG. 19.

Showing relations of bulb, membranous urethra and prostate to the deep perineal fascia or triangular ligament.—(After Gray.)

this region—quite as essential in urethrotomy with or without a guide, as in operating for stone. The relative positions of the bulb, prostate, membranous urethra and rectum are well shown in Fig. 18. The relations of

these structures are to be borne in mind in operating in this region, and a little time devoted to their review prior to undertaking an operation upon the deep urethra is never out of place.

Fig. 19 shows very clearly the relations of the various parts as seen in a vertical section in the median line.

## CHAPTER II.

### CURVE OF THE URETHRA.—INSTRUMENTATION OF THE URETHRA.

In order to thoroughly comprehend the essentials of the diagnosis and treatment of urethral stricture, it is necessary to have an intelligent idea of the normal conformation of the urethra and some of the details of instrumentation of the canal. One of the most important points is the normal curve of the urethra. The relations of this curve to the passage of instruments is a matter requiring the closest attention, and the possession or lack of knowledge in this regard is likely to determine in a great measure the result of the diagnosis and treatment of genito-urinary disorders. The surgeon who is ignorant in this direction can be but a bungler in urethral and bladder surgery, and bungling is nowhere more likely to prove disastrous than in this situation. It may also be said that accurate knowledge and manipulative skill is nowhere attended with more gratifying results.

#### NORMAL CURVE OF THE URETHRA.

As has already been remarked, the pendulous urethra has a variable curve, the direction and conformation of which may be modified by changes in the position of the penis. It may also be adapted to any form of instrument necessary for urethral or bladder manipulation. It is different however with the deep urethra. Posterior to the anterior opening in the triangular ligament, the urethra presents a relatively fixed curve, which, while it may be adapted to instruments of improper form and may even admit straight instruments, can only be so adapted by the use of some force, the infliction of considerable pain, and

danger of subsequent inflammation, which may involve the bladder, prostate, seminal vesicles, or testes. Rupture of the urethra may be produced by such faulty instrumentation. The curve of the urethra is altered by disease as has already been stated. Prostatic enlargement, tumors of the vesical neck and distention of the bladder are the principal conditions which lengthen the urethral curve and make it less abrupt.

The average normal curve as established by Bell, and verified by Thompson, Van Buren and others, corresponds to a circle three and one-fourth inches in

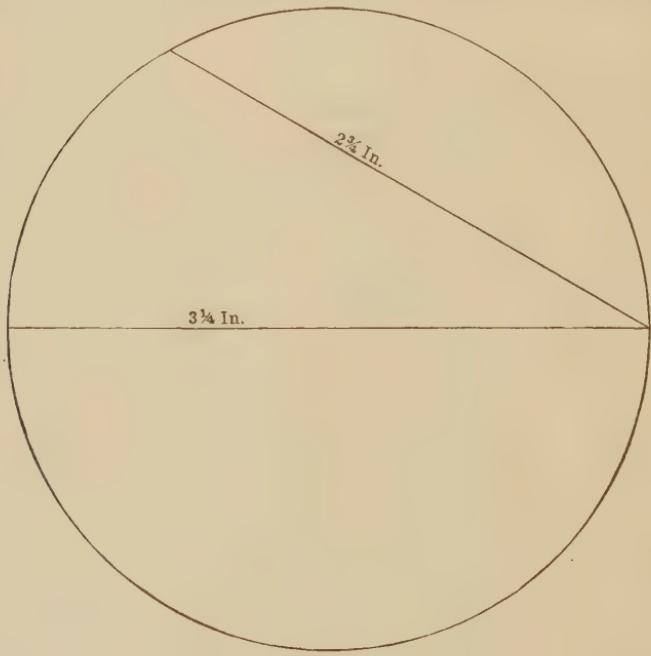


FIG. 20.

diameter, the proper length of curve for adaptation to the deep urethra being an arc of this circle subtended by a chord two and three-fourths inches in length.

The exact measurements are shown in the accompanying diagram, Fig. 20.

The length of curve as outlined by Thompson is too long for instruments as a rule. The shorter the beak

of the sound,—providing it be adapted to the normal curve,—the more thoroughly under control will the instrument be during instrumentation. A long curve, as Van Buren and Keyes long ago very properly asserted, is apt to cause unsteadiness and wabbling as the instrument enters and traverses the deep urethra. In case of obstruction, a long curve is likely to do more damage, if force be used,—as a more powerful leverage can be

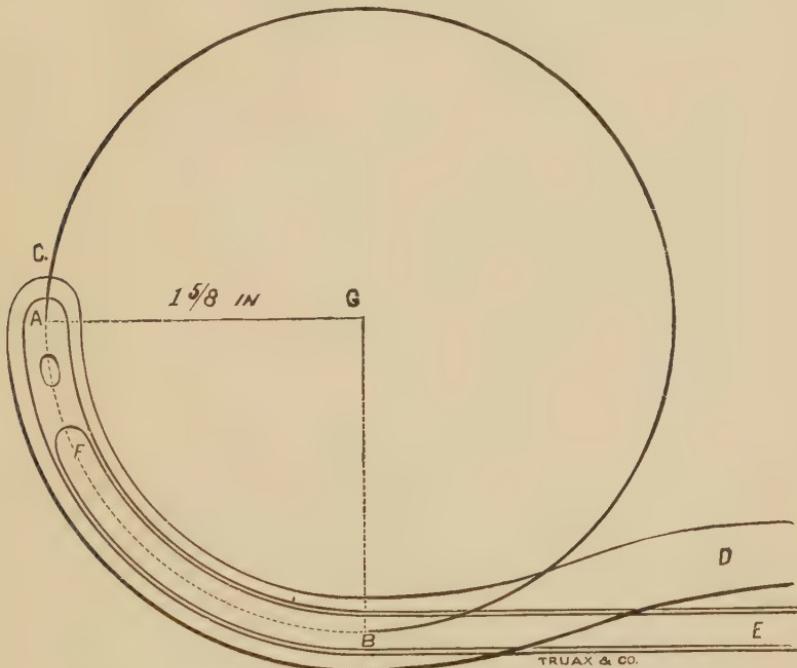


FIG. 21.

Showing the comparative curves of metallic sounds and catheters, favored by various prominent surgeons. Benique, C. B. D. Bumstead, F. B. E. Gouley, A. B. E. Otis, F. B. E. Van Buren and Thompson, A. B. E.

exerted by slight force, —than is the case with instruments of a short curve.

There has been considerable variation in the curve of sounds and catheters as designed by different surgeons. Unfortunately also, it would appear that no two instrument makers use the same standard

of construction. The French or Benique sound is perhaps the most faulty. This instrument was originally designed for use in cases in which it is desirable to allow a sound to remain in the bladder for some little time, it being supposed that the double curve made the instrument more comfortable to the patient. This idea is most fallacious, as all possible advantages are more than counterbalanced by the outlandish curve and the great distance to which the instrument penetrates the bladder. As a rule, the less the bladder is interfered with in passing sounds, the better.

In treating the prostate and vesical neck, or a stricture at the bulbo-membranous region, it is not necessary to explore the entire abdomen. I have known surgeons who, in treating stricture, even of the pendulous urethra, appeared to be trying to explore the patient's pharynx with the beak of the sound.

Figure 21 shows some of the varying curves of sounds and catheters recommended by various prominent surgeons.

#### INSTRUMENTATION OF THE URETHRA.

There is probably no department of surgery in which special skill is more pre-eminently necessary than in diseases of the genito-urinary organs, yet it is safe to say that in no department are so many abuses practiced. Men who would not think of prescribing for a diseased eye, will deliberately set about the treatment of severe and complicated urethral and bladder affections, which more urgently demand a specialist than the average case of ocular disease. To the average physician, the urethra is a canal through which an instrument ought to go and should be made to go, under any and all circumstances and at all hazards.

The results of this "stove pipe" surgery are really appalling, from the standpoint of mere mechanical results, to say nothing of the long train of patients with infected

bladders, damaged kidneys, prostatic abscesses, and false passages that follow in the wake of the incompetent surgeon. I feel that it is no exaggeration to state, that in no department of surgery is special skill so necessary, and at the same time so ignored, as in the surgical diseases of the genito-urinary organs. But, it may be asked, "must we send all of our profitable cases to the specialist?" By no means, providing the treatment of the case is likely to prove profitable to the patient as well as to the physician. But if, on the other hand, the physician is not competent to treat this class of affections, the patient will, on the average, stand a better chance if left to his own resources, than if submitted to the tender ministrations of a surgical blunderer.

As a preliminary to the purely mechanical features of urethral instrumentation, it is well to consider in how far we may apply modern surgical technique to this region.

MODERN ANTISEPTIC AND ASEPTIC METHODS AS APPLIED  
TO URETHRAL SURGERY.

There are many insurmountable difficulties in the way of absolutely aseptic and antiseptic methods in the treatment of genito-urinary diseases. The various portions of the genito-urinary tract are comparatively inaccessible, are colonized by germs of various kinds, and are bathed from time to time—or constantly, as the case may be—with a fluid, which, harmless *per se*—save by its irritating chemical properties—may yet be the carrier, or nidus for the development of noxious germs and their toxic products.

In short, drainage of these parts is very defective. To be sure, the germs that find their habitat in the urethra are not always noxious, but I hold the opinion that they may all—by evolution in a favorable environment—become pathogenic. A sound cannot be passed into the bladder, in all probability, without carrying in a

quantity of germs and germ products from the urethra. If, however, the bladder be normal, no injurious results will occur. If there be only a slight amount of residual urine in the bladder, decomposition may be set up and a cystitis will result. No matter how carefully we may attend to aseptic and antiseptic details in passing instruments for evacuating this residual urine, cystitis arises sooner or later. Indeed, it will arise even where no instrumentation whatever is practiced. Germs are ever present in the urinary tract, and their result depends entirely upon the local circumstances of environment. Germs of known pathogenic properties, and materials which may be elaborated by previously harmless germs into toxic compounds, are of course most likely to cause infection when conveyed into the urethra or bladder by unclean instruments.

As a broad general proposition, it may be accepted that, while we cannot as a rule prevent germs entering the genito-urinary tract, we may, by strict asepsis, antisepsis and drainage, obviate the dangers of operations to a very marked degree. We can usually avoid the direct introduction of pathogenic germs and their products, and we can certainly avoid the introduction of morbid material upon which the normal germs may feed, wax fat and become noxious. We may also, to a great extent, remove or neutralize the septic properties of material which may form in the genito-urinary organs.

A point well worthy of attention in this connection, is the fact that the delicate structures of these parts do not tolerate very strong antiseptics.

Another circumstance having a decidedly practical bearing upon urethral surgery is the difficulty of obtaining rest. The penis is subjected to varying conditions of blood supply, incidental to various irritations of a sexual or ordinary character. The bladder and urethra are also frequently disturbed by the accumulation and discharge of the urine.

The best means of preventing infection of the genito-urinary tract by instrumental manipulations are embraced in the simple term, cleanliness. A perfectly clean instrument is as aseptic as may be, but one which is in the slightest degree contaminated is fraught with great danger to the patient. The unfortunates who have been slain, or hopelessly crippled, by a dirty catheter or sound, in the hands of a dirtier doctor, might, if the truth were known, rival in numbers those troops of shades with uncured gleets, whom Ricord said he met in Purgatory.

The most effective means of aseptizing instruments is by boiling, or the use of the steam sterilizer. Before all cutting operations upon the urethra this plan should always be followed. In ordinary everyday office routine, however, this is not so practicable, nor is it, perhaps, absolutely essential. The surgeon should provide himself with an instrument tray, which will hold the necessary syringes, sounds, etc. In this tray the instruments should be kept in a bath of 5 per cent carbolic-acid solution. Each instrument should be immersed in this solution before being used, and after use should be carefully wiped on a clean cloth and returned to the bath. If the instruments are well polished and plated, they will not rust in the bath if immersed for a short time. The appearance of rust in the water, or on the instruments, means a defect in the plating.

Too much care cannot be given to the surface of sounds and other metallic instruments;—the slightest defect constitutes a nidus in which morbific material may lodge. Irregularities of surface are also very irritating to the delicate mucous membrane of the urethra. A perfectly smooth sound will often pass readily where a slightly defective instrument will excite the most intense urethral spasm. The same remarks are pertinent as applied to soft bougies and catheters. These latter lose their gloss quite readily, the more especially

as antiseptic solutions and hot water are very destructive to them. The pure rubber variety, however, will stand hot water and carbolic solution much better than the woven and gum catheters. Immersion in a 1 to 1000 bichloride solution is quite effective and not so detrimental to soft instruments as solutions of carbolic acid. Before all important operations on the urethra the canal should be flushed out with a solution of bichloride, 1 to 5000, or a saturated solution of boric acid.

*Lubricants for Instruments:* Time was, when the *armamentarium chirurgicum* of the genito-urinary surgeon was not considered complete without a bottle of rancid smelling olive oil for lubricating purposes. If the surgeon could procure a bottle of pomade in its sere and yellow leaf, then indeed was he happy. This condition of affairs has unfortunately not entirely disappeared. Should the novice suppose that this is an overdrawn picture, let him inspect the tables of the first half-dozen general practitioners with whom he comes in contact and see what he will find. If he does not meet with my experience, and find a few of them using the soap from their office sinks, as a lubricant for their sounds and specula, he may be satisfied that the world does indeed move and is taking the dirty doctors along with it. The modern petroleum preparations are to a certain extent antiseptic, and as they are quite stable, they are much to be preferred to ordinary fats and oils for lubricating urethral instruments. Carbolized vaseline in 2 per cent strength, or sublimated vaseline 1 to 1000 are very serviceable. It is not unwise to add the muriate of cocaine five grains to the ounce. One of the latest and best of the petroleum preparations is the liquid albolene. I am using this to the exclusion of everything else.

In cases in which the sound is to be followed by astringent or antiseptic applications, some form of lubricant should be used which will not coat the mucous

membrane with a substance impenetrable to medicaments. Glycerine and egg albumen are unobjectionable from this standpoint, although neither of these materials is as efficacious as a lubricant as the oils and fats. Glycerine is quite irritating to some urethræ.

The following formula constitutes an excellent lubricant.

## R

Hydg. Bichlor. gr. ss.

Cocaine Mur. gr. v.

Liq. Albolene ʒ j.

M.

By heating the Albolene before adding the bichloride, a more satisfactory mixture is obtained.

Instruments should be warmed, as a rule, before their introduction into the urethra. Not only is their passage thereby facilitated, but urethral chill is much less likely to occur. There is the greatest imaginable difference in the readiness with which warm and cold sounds enter the urethra, as may be demonstrated by anyone who cares to make the test—and there is no test equal to the passage of an instrument upon oneself. Urethral chill is often greatly a matter of nervous shock, hence the wisdom of warming urethral instruments as a prophylactic of rigors. Obviously, the reflex impression is likely to be most profound from a cold instrument.

## SELECTION OF INSTRUMENTS.

*Size of instrument:* The most useful rule which can be formulated for our guidance in urethral surgery is, never to introduce an instrument which will not pass without the exertion of any great degree of force. The general and trite maxim is, never to pass an instrument which will not enter by its own weight. This is a most ridiculous proposition in some respects. It will apply to the normal urethra and to large sized sounds, but not to canals of small calibre due to pathological con-

ditions. The very men who formulate this rule in textbooks, are violating it daily in practice; if they do not do so, they certainly must fail to pass an instrument quite frequently. I do not believe that any arbitrary rule can be formulated. In a general way it may be said, that an instrument which requires for its passage any more force than is necessary to adapt it to the canal and keep it in the proper line, is too large for introduction. Wedging an instrument through an obstruction is bad practice. Only long experience can teach the surgeon when, where, and in what degree he may use force in passing instruments upon the urethra. Nowhere is the *tactus eruditus*, born of clinical experience, as essential as in genito-urinary surgery. In a general way the proposition is a safe one, that instruments are to be coaxed, not driven through the urethra. The surgeon who does the most coaxing and the least driving, is the true artist in genito-urinary work.

Small instruments of metal should never be introduced into the urethra where possible to avoid them. In dilating stricture, soft instruments should be used, up to a calibre of eighteen to twenty Fr., after which the steel sounds should be substituted. I am very much puzzled to understand why it is, that instrument makers will persist in getting up sets of sounds for professional tyros, scaling down to the size of a knitting needle. To my mind, the man who displays such a set of instruments makes out an excellent *prima facie* case of daily and frequent malpractice against himself. As to the manufacturer who may design these abominable "sets" for the unwary recent graduate, he ought to be prosecuted for aiding and abetting homicide.

#### SCALING OF SOUNDS AND CATHETERS.

As is well known, the numbering of sounds and catheters has been greatly a matter of caprice with various instrument makers. It makes the average man

very weary to even attempt to understand the precise significance of the numbers upon instruments. Instruments supposed to be numbered upon the English or American scales are found to vary in a marked degree, the same numbers on the same scales rarely corresponding in instruments of different makes. The length of sounds varies quite as much as the diameter, a difference of two or three inches in length of sounds of different makers being nothing unusual. The only approach at uniformity of measurement of diameter, is the French scale. This, if accurately followed, reduces the measurement of instruments to mathematical exactness. The numbers of the French scale indicate at once the circumference of the sound or catheter. Beginning at No. 1, each increase in number indicates an increase of one millimetre in circumference. For practical purposes this fine gradation of sizes is not necessary, every second number being all-sufficient for everyday use. A set of sounds comprising every other number, from thirteen to thirty-five Fr., inclusive, forms a practical outfit. This is especially true because of that fact that the modern conical sounds vary in size from the beginning of the curve to the tip. A urethra which will take the shaft of one instrument will certainly admit the point of the next larger size. A very useful device for determining the size of instruments are the scale plates shown in Figs. 22 and 23. These have the several scales marked upon them.

The conical point is a great improvement over the old-fashioned, relatively blunt instrument, especially as regards its facility of introduction. A little more care, however, is necessary in its use, as it acts decidedly upon the wedge principle, and the surgeon is likely to be tempted to introduce a larger instrument than is wise.

FORM OF SOUNDS AND METALLIC INSTRUMENTS.  
A few general remarks regarding the most desirable

form of sounds may be of service. In a general way it may be stated that a properly made sound should be as short as is compatible with the length of the urethra. There is a tendency on the part of instrument makers

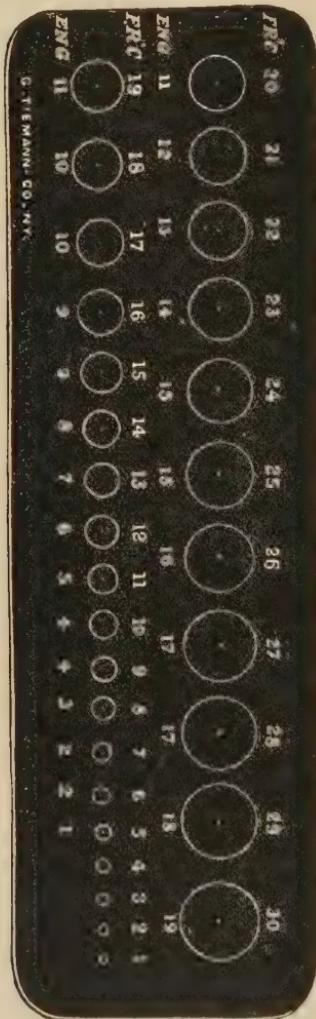


FIG. 22

AMERICAN SCALE		FRENCH SCALE (CHARRIERE FILIERE)	
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9
10	10	10	10
11	11	11	11
12	12	12	12
13	13	13	13
14	14	14	14
15	15	15	15
16	16	16	16
17	17	17	17
18	18	18	18
19	19	19	19
20	20	20	20
21	21	21	21
22	22	22	22
23	23	23	23
24	24	24	24
25	25	25	25
26	26	26	26

J. REYNNDERS &amp; CO.

FIG. 23.

to manufacture the most ungainly instruments that can possibly be devised. Every fraction of an inch in the length of a sound, over and above what is really neces-

sary to enter the bladder, makes the instrument proportionately more difficult to manage. As already stated, the farther the point of the sound is from the hand, the less the control of the operator over the instrument, and the greater the danger of inflicting injury by careless manipulations. It does not seem to dawn upon some surgeons, that in dilating or exploring for stricture, it is not absolutely essential to punch the point of the sound violently against the fundus of the bladder. It is by no means necessary to superadd traumatic cystitis to urethral stricture. A comparison of different makes of instruments shows the greatest imaginable variation in length. I have in mind at the present moment, a set of sounds furnished by an instrument house of this city to one of our hospitals, that are monstrosities of form. The man does not live whose urethra can take the full length of one of these sounds without the point pressing forcibly against his bladder—unless the latter be distended. Every time a sound of this kind is introduced



in the orthodox manner—with the handle well down between the thighs—the bladder walls are bruised by the point of the instrument.

FIG. 24. In properly made metallic instruments, the point is at a right angle with the shaft, as shown in the accompanying illustration.

#### METHOD OF INTRODUCTION OF INSTRUMENTS.

Nothing could be more difficult than to convey an understanding of the proper method of instrumentation of the urethra by mere verbal description. Only careful clinical instruction and considerable personal experience, will impart a practical working idea of the subject. There are some points of a general character, however, upon which it is always profitable to elaborate

in a work of this kind. These points may be covered by a description of the introduction of an ordinary sound or catheter.

The late Professor S. D. Gross, was wont to say, regarding the magnitude of operations upon the urethra: "The introduction of the sound is one of the nicest, and most delicate processes of surgery. It requires skill of the highest order, as well as the most intimate knowledge of the anatomy of the urinary organs. If I were called upon to state what I considered as the most important operation that a practitioner is called upon to perform, I should unhesitatingly say, the introduction of a sound." This assertion from the Nestor of American surgery is more than the most arrogant of genito-urinary specialists could ask for; it certainly is enough to warn the ignorant bungler of the dangers to which he subjects his hapless patients with genito-urinary affections, every time he inserts an instrument into the urethra.

I am often asked by medical students, whether I cannot suggest some method of training by which they may become proficient in urethral instrumentation, I invariably advise them to practice the necessary manipulations upon themselves. Once let a man become intimately acquainted with the sensation imparted by a sound or catheter and he acquires a *tactus eruditus* which years of observation would fail to impart to him. My personal opinion is that *no man is competent to pass an instrument upon a patient until he has practiced the maneuver upon himself a few times.*

To a certain class of surgeons, urethral manipulations afford a grand opportunity for theatrical display. I have in my mind's eye at the present writing a celebrated eastern surgeon, whose antics, when standing before his class, sound in hand, are a symphony of flourishes. Another well-known western surgeon, whom I have seen operate on many occasions, introduces a

sound with so rapid and triumphant a sweep and such a self-satisfied "see-me-do-it" expression that my fingers fairly itch to thrust a 40 French into his anatomy as an object lesson in urethral surgery. It would be interesting to know how many ruptured urethræ, urinary extravasations, fatal urethral chills and false passages are credited to this man in the book of errors. To the student who has been taught by conservative, modest and pains-taking surgeons, this digression is a work of supererogation, but to him who has been dazzled by the æsthetic flourishes of the surgical fop or the boisterous self-sufficiency of the surgical ruffian, the foregoing remarks may be serviceable. All that glitters is indeed not gold in the surgery of the genito-urinary apparatus.

In the description of the proper method of passing urethral instruments, I shall waste no time in resurrecting such relics of the past as the *tour de maître*. This maneuver, and those which are a compromise with it, cannot too soon be consigned to the oblivion of the dead lumber room of surgical fads and fancies. It is unworthy of discussion, and to present it would be an invocation of ghostly witnesses of its barbarity.

#### OPERATION.

The patient should be placed upon his back, preferably in the semi-recumbent posture, with the thighs flexed upon the abdomen and the legs upon the thighs. The feet should rest on a support at a lower level than the body. The small platform of the ordinary gynaecological chair is very convenient as a foot-rest. After the patient has become used to the passage of instruments they may be introduced in a standing position if desired. In some patients I have found that a sound or catheter may be introduced with more facility with the patient in the erect position. Until the patient has become inured to instruments, however—and invariably when there is the slightest tendency to syncope during instrumentation—the recum-

bent position is imperatively necessary. It is a decidedly unpleasant experience to have a patient unexpectedly fall to the floor in a dead faint, during the passage of a sound or catheter.

The patient being in proper position, the instrument should be rendered aseptic, warmed and well lubricated with some antiseptic lubricant mixture.

The operator had better become accustomed to the use of either hand in introducing instruments. As in all special regional surgery, ambidexterity is here of great service. If the instrument is to be passed with the right hand the surgeon should stand on the left of the

patient and vice versa. The instrument should be held in the hand pen fashion, and not grasped as if it were a club. The penis is held lightly between the fingers and thumb of the opposite hand and the point of the instrument engaged in the meatus. (Fig. 25.)

The shaft of the instrument should be parallel with Poupart's



FIG. 25. (*Keyes.*)

ligament and almost in contact with the body of the patient. The instrument being now in proper position for introduction, the penis is slowly and gently drawn up over the instrument with the free hand until about four inches of the curve and shaft have been introduced. The handle is now gradually raised, the point being at the same time dipped well down toward the perineum. When the point has arrived approximately at the opening in the triangular ligament, the handle should be swept toward the median line of the patient's

body. (Fig. 26.) The free hand should meanwhile gather up the testes and raise them directly upward, the little finger of the hand that is engaged in this maneuver

being used to follow the point of the sound as it traverses the perineum. The instrument is now in position to enter the deep urethra and its point is usually at this time within the aperture in the triangular ligament, if, as is pro-

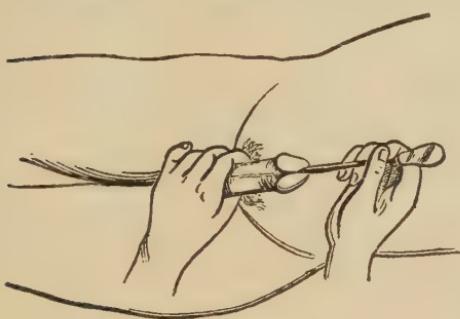


FIG. 26. (Keyes.)

proper, the handle has been slightly raised as it makes the detour to the median line.

The handle is now raised to the perpendicular, thus bringing the point deep down into the perineum and causing it to traverse the membranous and enter the prostatic urethra. (Fig. 27.) The testes are now allowed to drop to their normal position, the free hand being at the same time pressed upon the mons veneris to stretch the suspensory ligament of the penis.

The handle of the instrument is now swept toward the patient's feet, being allowed, as far as pos-

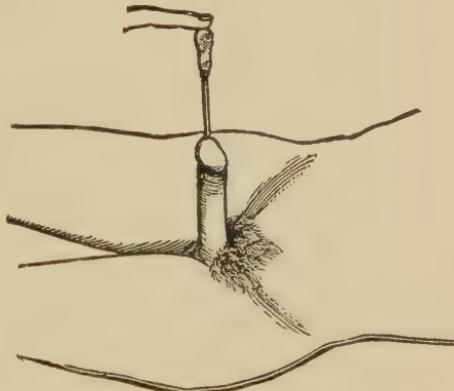


FIG. 27. (Keyes.)

sible, to enter by its own weight—a point already expatiated upon. (Fig. 28.) Great care should be exercised in this final sweep, as it is here that the point of the instrument is most likely to be obstructed by either spasm

or organic contraction. It is here too that the leverage principle of the sound is most potent for evil. Great damage can easily be inflicted by very slight force. The sound should not be swept downward quickly, else the urethra may be torn completely across if obstruction exist. A false passage is very easily produced at this point by comparatively little effort, particularly if the urethra be diseased.

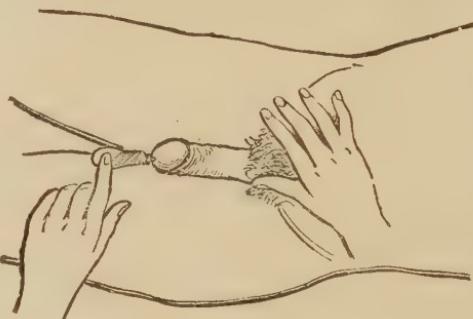


FIG. 28. (Keyes.)

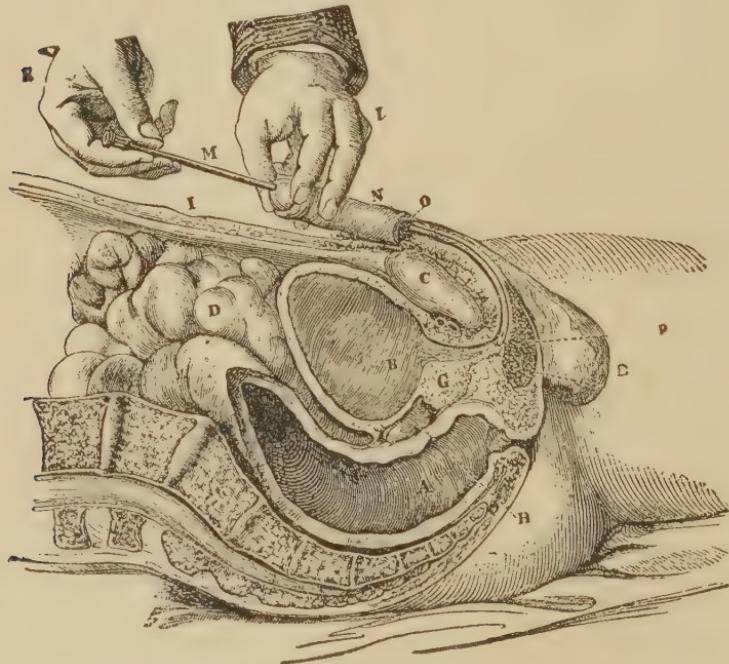


FIG. 29.

Showing position of catheter in second stage of introduction.—(After Voillemier.)

We are never justified in assuming that there is no obstruction, but should always take it for granted

that it exists. I have heard a surgeon say that he thought a certain stricture was "spasmodic," upon which he thrust a sound into the bladder as rapidly as possible, "to take the muscles by surprise," he said; but to my notion for the purpose of display. This gentleman had no authority even for the assumption that his patient had a stricture, and as for determining its character without exploration, that was obviously impossible. Had the patient's urethra been organically obstructed I fail to see how it could possibly have escaped serious injury. This was, however, a fair sample of the work of the "stove-pipe" surgeon, whose apprenticeship should be in a plumber's shop rather than in a physician's office; and there are many of

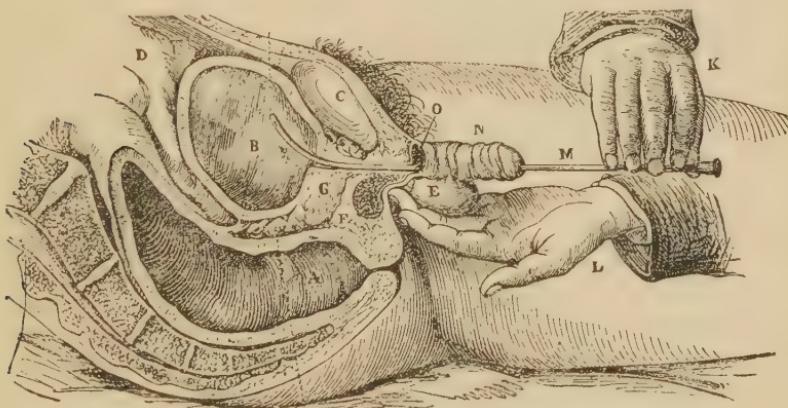


FIG. 30.

Showing position of instrument in final stage of its introduction.—(After Voillemier.)

his ilk who fill high places, with profit to themselves even if with disaster to their patients.

A very little deflection from the proper line as the sound or catheter enters the perineal portion of the urethra is sufficient to cause great trouble in introduction. The temptation, of course, is to use force in the further passage of the instrument.

It must be remembered, however, that the introduc-

tion or an instrument should be a process of coaxing—not driving. The more the operator tries to force his way through, the more resentful the sensitive urethra becomes. Let slowness and gentleness be the watch-word, and the surgeon is not likely to do damage in his urethral work.

Very often the point of the sound is arrested by spasm at the musculo-membranous region. A little steady and gentle pressure will usually overcome this obstruction. Very often diversion of the patient's mind

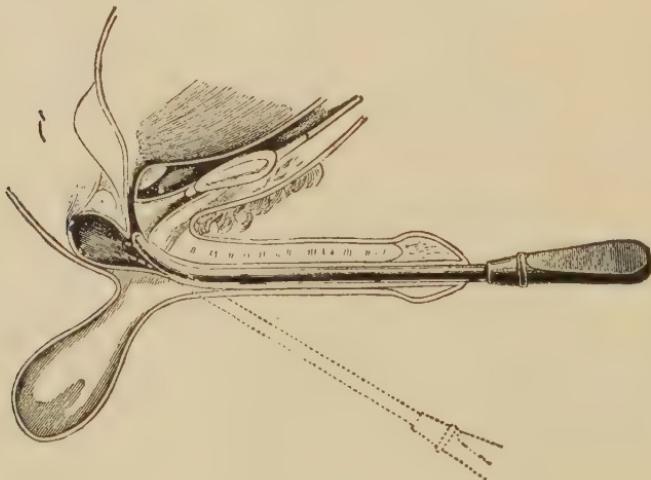


FIG. 31.

Showing correct and faulty positions of point of an instrument at the bulb.—(After Culver & Hayden.)

is all that is necessary, as much of the obstruction is caused by voluntary contraction of the auxiliary cut-off muscles. In some instances the spasm will be relaxed by a voluntary effort to micturate. This brings the physiological inhibition of the cut-off muscle to the assistance of the surgeon. A hypodermic of morphia half an hour before the exploration is often of value. A few drops of a two to four per cent. solution of cocaine instilled into the urethra five minutes before the *scance* are usually effective, but must be employed

with extreme caution. Full anæsthesia may be necessary.

Dipping the point of the instrument well down into the perineum before sweeping the handle to the median line, is a most valuable procedure and renders the introduction of an instrument much easier.

# CHAPTER III.

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## STRICTURE OF THE MALE URETHRA.

### DEFINITION AND VARIETIES.

#### SPASMODIC, CONGESTIVE AND INFLAMMATORY STRICTURE.

STRICTURE OF THE MALE URETHRA is by far the most important of all the surgical diseases of the genito-urinary apparatus. It is of importance not only because of its extreme frequency,—the special condition which most often gives rise to it affecting sooner or later a large proportion of male humanity,—but because of its important relations to secondary pathological conditions of organs more vital than the structure primarily affected.

Stricture of the urethra may be defined as an abnormal diminution of the lumen of the canal at one or more points or throughout its entire course, due to any cause whatsoever, whether temporary or permanent. Thus it may arise from any of the following conditions:

1. *Pressure from without*, due to (a) neoplastic formations; (b) extravasations of blood or urine from injury; (c) purulent collections and infiltrations; (d) fracture of the pelvic bones.

2. *Spasm of the muscles in and about the urethra*, due to: (a) direct irritation by lesions of the canal; (b) direct or reflex irritation from foreign bodies in the canal; (c) reflex irritation from more or less remote pathological conditions; (d) the introduction of instruments; (e) emotional excitement; (f) malaria (?); (g) highly acid and concentrated urine and occasionally oxaluria and gravel.

3. *Congestive or inflammatory engorgement of the urethra*, due to: (a) acute urethritis; (b) traumatism of the urethra; (c) inflammation in and about organic obstructions.

4. *Thickening of the urethral walls*; due to: (a) congestive and granular patches in the mucous membrane, i. e. superficial infiltration from chronic inflammation; (b) plastic infiltration and formation of connective tissue in the meshes of the corpus spongiosum, from severe and long continued inflammation; (c) cicatricial deposit in the corpus spongiosum and urethral walls incidental to traumatism; (d) cicatricial deposit incidental to the action of various caustics and powerful irritants; (e) cicatricial deposit incidental to ulceration or sloughing from impaction of foreign bodies.

5. *Deficient elasticity of the urethral walls and corpus spongiosum*: (a) from congenital sparsity of elastic and muscular fibre and a preponderance of fibro-connective tissue; (b) from inflammation.

6. *Congenital narrowing of the urethra*, or slight atresia from defective foetal development.

7. *Polypi* of the urethral mucous membrane.

From a clinical standpoint, strictures may be divided as regards their origin into: (1) congenital; (2) acquired. (a) traumatic; (b) chemical; (c) acute inflammatory or congestive; (d) chronic inflammatory; (e) neurotic.

As regards the essential condition producing the obstruction, they may be divided into: (1) spasmodic; (2) congestive or inflammatory (circumscribed or general); (3) organic or fibrous (permanent), i.e. neoplastic.

Those varieties of stricture, the nomenclature of which depends upon real or supposed differences in the condition producing the obstruction, are not always to be differentiated clinically because of the fact that the several conditions may co-exist and be blended in varying proportions in any given case of the disease. Thus inflammatory or congestive narrowing of the urethra, although sufficient *per se* to produce obstruction in some cases, is nearly always complicated by spasmodic narrowing of the canal. Simple spasmodic stricture is rela-

tively rare, occurring only as a result of reflex irritation of a remote character, mental impressions, or instrumentation where the urethra is very sensitive. On the other hand, spasmodic stricture dependent upon acute or chronic organic changes in the urethral mucous membrane is very frequent. Again, there are few cases indeed, of organic stricture, that are not complicated at one time or another by inflammation, congestion or muscular spasm; in fact, all of these elements—which I will style plus conditions—and particularly spasm, are apt to require attention at various times during the treatment of organic stricture.

### SPASMODIC, CONGESTIVE AND INFLAMMATORY STRICTURE.

#### SPASMODIC STRICTURE.

*Spasmodic Stricture*—or, as it may justly be called, *pseudo-stricture*—may be defined as a diminution of the calibre of the urethra, due to spasmodic contraction of the muscular fibres in and about the walls of the canal. Its existence was for a long time denied. It would appear that everyday experience should have taught the practical surgeon at a very early period, that such a condition as spasmodic urethral stricture was possible. It seems, however, that such was not the case for some time. The varying calibre of the urethra during the progress of a course of treatment for stricture—or during the natural course of that disease unmodified by treatment—is very strikingly suggestive of the element of spasm, for it will often be found that a stricture which will at one sitting admit a sound of fair size, will at another time only permit the passage of a very small instrument, or perhaps none at all. Complete retention may occur at any time as a result of such exciting causes as acid urine, intemperance, sexual indulgence, and so on. To be sure, spasmodic contraction is associated very often with congestion and inflammation,

but in most instances spasm is the preponderating condition in the case. Again, an instrument may be obstructed during its passage into the urethra until after gentle pressure is exerted, when it will pass the point of contraction quite readily. The grasping of the instrument by the urethral walls as it is withdrawn, proves conclusively the existence of spasmodic contraction in and about the canal.

Notwithstanding the facility of demonstration of spasmodic stricture, the profession did not accept the existence of this condition until Hancock and Kölliker demonstrated the existence of muscular fibres in the urethral walls. The researches of these investigators, although valuable, unfortunately led to the erroneous inference that contraction of these fibres was the most important element of spasmodic stricture. A comparison of the mechanical effects produced by spasmodic stricture, with the power of the muscular fibres which were supposed by them to be chiefly concerned in the production of the spasm, will readily demonstrate the fallacy of this belief. The planes of muscular tissue are chiefly longitudinal and so sparse, that no matter how firmly they might contract, they would be incapable of seriously obstructing the passage of instruments, or producing retention of urine. We must, therefore, look further for the seat of the spasm in pronounced cases, and seek for those structures the function of which is to normally obstruct the canal and prevent the escape of urine. *A group of such structures is found in the cut-off muscle of Cruveilier, and it is at a point in the urethra corresponding to this muscle, or group of muscles, that the principal spasm occurs.* The last few drops of urine and semen are extruded under normal conditions by the accelerator urinæ and compressor urethræ muscles; simultaneously with this expulsion of fluid the cut-off muscle closes the deep urethra and the neck of the bladder. *Spasmodic stricture is merely an intensification of this*

*physiological function, in which, from various sources of irritation, the muscle is spasmodically contracted and the volitional power of the patient over the act of urination is for the time being held in abeyance.* The accelerator urinæ and compressor urethræ muscles play but a minor part in the production of such a spasm, the chief factor being the contraction of the voluntary cut-off muscle. A certain amount of spasm however, due to contraction of the circular fibres of the urethra, may occur at any portion of the canal, and probably constitutes a certain proportion of the obstruction experienced in the introduction of instruments in cases of stricture of large calibre located in the pendulous urethra. It is this

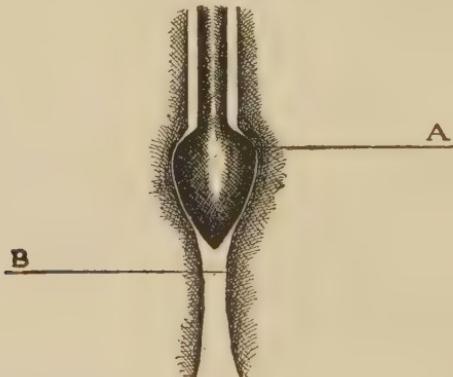


FIG. 32.

Fig. 32, showing the manner in which the urethra resents the passage of the bougie *a boule*.  
A, bulb, caught at point of narrowing, B, urethral walls opposing passage of bulb.

spasm which facilitates the exploration of the urethra by means of bulbous instruments, inasmuch as it is through it that the sensitive urethra resents at certain diseased points, the introduction and withdrawal of the bulb of the instrument and thus gives evidence of obstruction.

*The site of spasmodic stricture varies.* There are most always two points of spasmodic contraction: (a) At the point of irritation, and (b) in the musculo-membranous urethra.

1. When a foreign body is introduced into the canal, the urethra resents the liberty at any point of irritation, and there occurs simultaneously with the slight contraction at the point irritated, a reflex spasm of the cut-off muscle. The same is true in cases of organic stricture in the penile portion of the urethra or at the meatus. The introduction of an instrument produces stretching and irritation of the lesion in the anterior portion of the canal and excites reflexly, spasm of the deep urethra, so that we find in quite a large proportion of cases of stricture, at least two points of obstruction, one in the diseased portion of the canal against which the instrument impinges, and another when the instrument strikes the deep urethra. The same spasmodic contraction results when the anterior obstruction is a congenital stricture or point of normal contraction. *This is an important practical point, for it has been established that, simultaneously with the removal of the anterior point of obstruction and irritation, the supposed deep organic stricture disappears.*

2. The entire canal may be spasmodically contracted and resent the introduction and withdrawal of instruments.

3. The musculo-membranous region may alone be involved. This happens in cases in which an organic lesion exists in the deep urethra and those in which spasm is due to reflex causes.

#### CAUSES OF SPASMODIC STRICTURE.

*The causes of spasmodic stricture, may be classified as:*

1. *Predisposing Causes.* (a) general hyperæsthesia; (b) local hyperæsthesia. Both of these causes are modified by a nervous temperament, debilitated and cachectic states of the system, the rheumatic and gouty diatheses, intemperance, high-living, faulty sexual hygiene, etc. (c) Acute or chronic disease of the urinary organs.

This is the most frequent predisposing cause, and it is rarely indeed that a case of spasmodic stricture is met with, in which a more or less damaged state of the canal does not exist. So uniformly is it present, that it is always to be suspected until organic disease has been excluded by exploration. Congested and fungating patches, erosions of the mucous membrane, acute and chronic urethritis, and stricture of whatever degree, constantly predispose to spasmodic contraction, both at the point of irritation and at the cut-off muscle; such predisposing causes are almost always effective in its production during the passage of an instrument. A congenital narrowing of the meatus or other parts of the canal, may give rise to reflex spasm of the deep urethral muscles in any case in which an instrument is passed, of a sufficient size to produce stretching of the sensitive tissues at the point of contraction. As already noted, when instruments are introduced under the pathological conditions alluded to, there is a spasm at the site of the lesion and another deep down in the canal.

2. *Exciting Causes.* 1, Passage of instruments; 2, sexual excitement or excess; 3, injury to the canal—chemical or traumatic; 4, a debauch; 5, cold-taking; 6, foreign bodies; 7, drugs, such as cantharides and turpentine; 8, reflex irritation; 9, malaria (?); 10, mental emotions.

A survey of the various exciting causes of spasmodic stricture, is sufficient to indicate the fact that in nearly all instances the element of spasm is associated with congestion and inflammation,—conditions which such special causes are most apt to excite. Spasm due to drugs is usually associated with considerable inflammation and attended by frequent and painful micturition (strangury), perhaps associated with urethral hemorrhage. *The most frequent exciting causes are intemperance, exposure to cold and wet, and sexual excess.* Highly acid urine in gouty patients is said to act as an

exciting cause *per se* in some cases, but it is in the highest degree doubtful if such a condition of the urine could bring about obstructive spasm in the perfectly healthy canal. It is, however, an important element in spasm produced by excesses of various kinds and cold-taking. Instrumentation of a sensitive canal, especially if organic disease exists, is likely to develop spasmodic stricture which may last for some days or weeks.

Cases of intermittent spasm due to malaria and curable by quinine are recorded, but it is questionable whether malaria alone can act directly as an exciting cause; that it may predispose to spasm is admitted.

In passing instruments into the virgin urethra, in delicate and nervous patients,—whether organic disease of the canal exists or not,—the instrument is apt to meet with an obstruction in the deep urethra. This will generally pass off under gentle and continuous pressure with the beak of the instrument. As the instrument is withdrawn, a sense of biting or grasping upon it is experienced by the hand of the operator, and the patient may himself feel a sensation of traction in the urethra.

It is a matter of common observation that some individuals are unable to urinate in the presence of others. This has been already alluded to as a form of spasmodic stricture from mental emotion, but it is in all probability due, not to spasm, *per se*, but to inhibition of the volitional power over the cut-off muscle, and of the normal involuntary contraction of the detrusor urinæ muscle.

Reflex spasm of the cut-off muscle is most apt to arise from irritation of structures bearing a more or less direct relation to the genito-urinary tract through community of nervous supply; thus diseases of the bladder, kidneys, rectum and anus, are very apt to produce it. It is by no means an uncommon experience after forcible stretching of the sphincter ani in operations for hemorrhoids, fistula in ano, and rectal stricture, for reten-

tion of urine to occur as a consequence of reflex spasmodic stricture. Inflammation in and about the perineum may produce urinary obstruction through the medium of spasm, independently of pressure.

The practitioner should anticipate the probable occurrence of deep spasmodic stricture sooner or later, as an element in any vesico-urethral disease, whether acute or chronic. It must be distinctly understood that the point from which irritation is reflected, may be above or below the site of the spasmodic contraction, i. e., the perineo-urethral muscles.

During the course of a gonorrhœa the urinary flow may be greatly lessened, yet sufficient for all practical physiological needs, when suddenly, without the least warning, retention occurs. *And this without the slightest involvement of the deep urethra or bladder.* Ordinarily such retention means a deep extension of inflammation, but retention from this cause is not so sudden and is preceded by symptoms of prostatic or vesical irritation. In chronic prostatic irritation and in chronic cystitis, with or without calculus, sudden retention may occur at any time. In such cases it is congestion that constitutes the primal condition of obstruction, but it is the reaction of the muscular structures under irritation that brings about the sudden and final occlusion of the urinary way, with resulting complete retention.

As Le Dentu expresses it: "Spasm plays the principal role and congestion the preparatory."\*

In hypertrophy of the prostate, the least disturbance of the usual regimen or the slightest venereal or dietetic excess or exposure, causes congestion of the deeper parts of the urethra. This may, and often does, excite reflex reaction of the surrounding muscles with consequent sudden retention.

Some very interesting examples have been cited,

\*Le Dentu. Des spasmes reflexes de l'urethre. Ann. des mal. des org. genito-ur., April, 1892.

where irritation of neighboring parts has produced spasmotic retention. Thus Le Dentu cites a case of testicular neuralgia, the exacerbations of which were accompanied by spasmotic retention.\* The same author calls attention to the providential spasmotic retention that often prevents urinary extravasation in wounds of the urethra and perineum.

Uterine affections in women have been known to give rise to spasmotic retention, and it is probable that *post partum* retention often has a strong spasmotic element.

It has been held that injuries of parts very remote from the urinary apparatus may produce spasmotic retention. Thus a fall upon the knees, fractures of the ribs, surgical operations, (such as laparotomy), and many other accidents of a traumatic character, are sometimes associated with retention. That this retention is due to spasm I do not believe. Inhibition of the detrusor urinae or of volitional power over the cut-off muscle due to shock, *commotio-cerebri* or *commotio-spinalis*, seems to me a much more logical explanation. There may indeed be an apparent retention due to reflex inhibition of renal secretion, especially after abdominal operations. In some cases, obtunding of the sensory supply of the bladder from shock or concussion may have much to do with the temporary retention. In some of the slighter cases, exaltation of emotional sensibility may be a causal factor in the retention. A patient who has been operated upon or seriously injured is compelled to use a duck or bedpan—often with an attendant close at hand—the result is a temporary inhibition of the power to relax the cut-off muscle and consequent retention. I recently saw an excellent example of this. A patient upon whom I had operated for hydrocele by the injection of carbolic acid, developed retention which lasted for twenty-four hours. He made frequent attempts to urinate while

\*Op. cit.

in bed, but without avail. I called upon him for the purpose of catheterizing him, but before passing the instrument had him rise from bed and try to pass water in a urinal. Being left to himself for a few minutes he immediately, and with very little effort, emptied his bladder. The same peculiar effect is often observed in patients who attempt to defecate in a bedpan. Surely, spasmodic stricture of the anal sphincter does not explain such cases.

There is a condition which Dr. Fessenden Otis has termed *urethrismus, or chronic spasmodic stricture*, which is by no means infrequently seen, and which may result from various sources of irritation more or less remote. This condition may be due to chronic abscesses in and about the genito-urinary organs. Dr. Otis has reported a very interesting case of this kind, due to fistula and chronic abscess of the scrotum and testicles of long standing.\* An interesting case of chronic spasmodic stricture due to fissure in ano, was reported several years ago by Dr. L. Bolton Bangs, a competent andrologist of New York.†

Dr. Otis' remarks upon the subject of urethrismus are well worth repetition and they unquestionably prove that he is a keenly observant clinician ‡

"The term spasmodic stricture has usually been applied to all temporary contractions of the urethra, which interfere in any degree with either the passage of instruments into the bladder, or the voluntary discharge of urine from it. As thus understood it has been described as varying in degree from the slight localized muscular spasm, which but momentarily arrests the progress of an ingoing instrument, to the firm, close contraction which more or less persistently resists its introduction in skilled hands, or from that which occasionally diminishes the strength of the out-

\*Genito-urinary diseases, F. N. Otis.

†New York Medical Record, January 26, 1888.

‡Syphilis and the genito-urinary diseases, 1888.

going stream of urine in urination, to that producing complete and enforced retention of urine.

In whatever degree present in any case, it is claimed by all authorities to be characterized by its transient duration and its ready yielding to remedial measures. In accordance with this teaching, all permanent or habitual interference with urination or the passage of instruments (except in some rare instances complicated by vesical paralysis) must have an organic cause, and depend either upon the presence of an intra-vesical growth, an enlarged prostate, or of close organic stricture. It is also within the experience of many surgeons, to have seen supposed subjects of close organic stricture, placed upon the operating table for the performance of external perineal urethrotomy, and, when fully anæsthetized, to astonish the operator by permitting the full sized exploratory staff to slip easily into the bladder. In other cases, the entire absence of that peculiar resistance to the knife, which the experienced surgeon recognizes when dividing cicatricial tissue, and the failure to locate with exactness the contracted point, will suggest to the memory of some that occasional patients, perhaps similarly affected, have not escaped so easily.

Not unfrequently, persistent difficulty of urination, perhaps retention of urine requiring the habitual use of the catheter, has been observed by surgeons where no proofs of intra-vesical growths were present, and where the easy passage of an ordinary catheter precluded the idea of enlargement of the prostate or of close organic stricture.

If it can be proven that purely spasmodic urethral contraction may, and not unfrequently does, present all of the important diagnostic features of the true close organic stricture, and farther, if it can be shown that polypoid and prostatic obstruction are often simulated by a chronic spasm of the acceleratio<sup>n</sup> urinæ muscles—

producing obstruction and persistent closure of the membranous urethra,—then it will be conceded that failure to appreciate so important a complication will conduce to grave errors in diagnosis, terminating possibly in an operation for conditions which exist only in the mind of the surgeon."

Dr. Otis cites a number of interesting but by no means uncommon cases in support of his theory, upon which he remarks as follows: "There are several points in the foregoing cases, (which I think may be fairly claimed to be types of a class), which coincide with the accepted characteristics of true, deep organic stricture, and which, if not appreciated, would lead of necessity, to an erroneous diagnosis,—such as was originally made in each one of the cases reported."

These points are: 1. A gradual diminution of the stream of urine. 2. Persistent frequency of micturition. 3. Persistent resistance to the introduction of large instruments in the hands of skilled surgeons. 4. Distinct grasping of small instruments, and a gradual toleration of instruments of increasing size, and in this, so perfectly simulating the behavior of true organic stricture, that the most skilled and learned surgeons have been deceived by these conditions. 5. The persistence, during a long period of years, of all the symptoms which are recognized by authorities as characteristic of organic stricture.

Dr. Otis then calls attention to the view entertained by Thompson, Erichsen, Bumstead, Van Buren, Keyes, Stilling, Dittel, and others, that the grand distinguishing feature of spasmodic, as contrasted with organic stricture, is the transitory character of the former variety. He then quite pertinently remarks as follows: "If this view is not correct (and that it is not, the cases cited go to prove), it will be readily seen that those surgeons who differentiate organic from spasmodic stricture by what is claimed to be the distinguishing

feature, viz: the transitory character of spasmoid stricture, are liable to fall into the grave error of treating a reflex urethral spasm for organic stricture. It is not at all likely that the cases I have reported, in which this error was made, are all the cases in which such errors have occurred or are likely to occur. They are types of a class, and a large one too, which will necessitate the acceptance of other means of diagnosis than those now in vogue, before such errors can with certainty be avoided. First of these is the necessary knowledge of the normal calibre of the urethra in which symptoms of stricture are present; second, the size and condition of the external opening. If the measurements of these two points do not completely correspond, there is reason to believe that a reflex irritation may be present, which has the power of obscuring diagnosis. *If there is a stricture, at or near the meatus urinarius, acquired through a previous gonorrhœa or of congenital origin, contact of the urine with the sensitive mucous surface, (which is always present behind such a stricture), or contact with exploring instruments, is capable of exciting a spasm at the membranous portion of the urethra; a spasm which will often persist even when the patient is fully anæsthetized, and will continue up to the time that a complete division of the stricture is effected.\**

It may, I think, be safely claimed that no reliable examination of the deeper urethra can ever be made while a stricture, or even an erosion, is present in the anterior portion of the canal. Inferentially then, no treatment of deep stricture, *per se*, should be attempted, until the complete freedom from organic contraction of the anterior portions of the urethra is established."

The presence of the slightest contraction at any point as determined by the urethra-meter or bulbs and measurement of the circumference of the penis, is accepted by Dr. Otis as capable of producing reflex

\**Italics mine.*

irritation, which may result in spasmodic contraction, which shall possess all the recognized characteristics of a deep organic stricture.

It must at once be apparent to every experienced and practical surgeon, that Dr. Otis has given us in the foregoing remarks, a most valuable and practically reliable principle in genito-urinary surgery. So evident too, is the point involved, that one is inclined to wonder that it remained for Dr. Otis to discover. *It is found for example, that in quite a large proportion of cases of penile stricture, a sound which is large enough to put the contraction on the stretch, either will not enter the bladder, or, if it does do so, it is only with great difficulty.* A bulbous flexible bougie of any size, will not enter at all, and even if a small one does succeed in passing the deep urethra, it is firmly grasped on withdrawal, the sensation imparted to the hand being not always deceptive to the expert, but to the surgeon of little or moderate experience, constituting irrefutable evidence of deep organic stricture. *Should a slight amount of organic linear contraction be present to impart a distinct grating feel to the passage of the bulb over the contracted part, then indeed is the deceptive simulation of true, marked organic contraction complete.*

A recital of personal cases is often of value, but a repetition of a number of cases of a similar character is on the other hand apt to be tedious, especially if the principle, to elucidate which the report is made, is one that has come to be well recognized. It may however not be out of place for me to offer a single case with some very interesting features, as illustrative of a type which is met with great frequency.

*Case illustrative of chronic spasmodic stricture:* W. B., Age, 29; Occupation, Architect. This gentleman had always been a very healthy man until twenty years of age, when he contracted a severe gonorrhœa, which lasted him for many months. This attack was followed

by a succession either of re-infections or exacerbations of a chronic urethritis. He finally got apparently well and remained so for several years. About four years before I saw him, he began to be annoyed by symptoms of stricture, following a fresh attack of urethritis. This was treated spasmodically, and maltreated constantly. One surgeon in particular had been so rough in his manipulations that it was feared a false passage had been produced. The patient stated that for two years he had had at short intervals,—usually after sexual or vinous indulgence,—complete retention of urine, the stream during the intervals of complete retention being very small and much time being required for the complete evacuation of the bladder. Relief of retention was always afforded by the passage of a small bougie with which the patient was constantly armed. Shortly before consulting me, he had been under the care of a surgeon who was enthusiastically trying to cure the case by electrolysis. I found on examination a meatus with a calibre of 20 Fr. Just within the meatus was a stricture of a calibre of 17 Fr. This was excessively irritable, and attempts at exploration were quite painful. At a depth of two and one-half inches was an irritable annular stricture of a calibre of 22 Fr. At three inches and a quarter was another stricture, evidently linear, which admitted only 17 Fr. The bulbo-membranous region was so tightly contracted that No. 4 Fr. was passed only with the greatest difficulty. As the patient was averse to an operation, I was compelled to do what I could by gradual dilatation, and succeeded in dilating up to No. 10 Fr. Attempts at further dilatation simply made a bad matter worse, and brought on an attack of retention which the patient himself relieved with the bougie.

An operation on the anterior strictures was now consented to. I had informed the patient that I had formed the opinion that the deep stricture was spas-

modic, but apprised him of the possible contingency of a perineal section in case it should prove to be organic and resisted dilatation after the anterior strictures had been removed. I performed internal urethrotomy, and remarked to the gentlemen who were present at the operation, that I expected to demonstrate what I had often shown in similar operations, that the deep stricture was spasmotic. Much to my chagrin I could not pass the deep urethra with the sound after the anterior urethra had been thoroughly freed from contractions. I invited my friends to the perineal section which I expected to perform as soon as the patient's consent should be gained. One week later I prepared the patient for the operation, and placed him in position, under anaesthesia. To the accompaniment of the friendly gibes of my professional friends, I remarked: "We will see if our stricture is still with us," picked up a 30 Fr. steel sound and fairly dropped it—so easily did it pass—into the bladder. I immediately passed larger sounds in succession up to 35 Fr.

This patient got perfectly well and was married four months later. The sequel of the case was quite amusing as well as interesting. Some three months after his marriage I was called to the patient's house, and found his wife suffering from a miscarriage due to the carelessness of a physician who had been probing the uterus—to cure a supposed uterine trouble, with which the young woman supposed herself affected when certain anomalous symptoms incidental to her pregnancy developed. The gentleman himself was lying in bed suffering from a terrific epididymitis, secondary to a virulent urethritis contracted two weeks before. The humor of the situation was complete when I set his mother-in-law at work making poultices for the young man's testicular rheumatism.

The epididymitis and gonorrhœa in this case recov-

ered very promptly, and there was no recontraction of the strictures when I last examined the urethra.

In some instances, spasmodic stricture is a very obstinate and annoying obstacle to the treatment of organic disease of the canal. I have had under my observation several cases of this kind. In one of these, a gentleman of highly nervous temperament—I cut a contracted meatus, with the result of relieving the frequency of micturition, which was annoying the patient greatly at night. There was no contraction susceptible of operation in the remainder of the penile portion of canal, but there was a very slight organic contraction in the deep urethra. Such severe spasm was produced by efforts at dilatation that it was found impossible to introduce soft instruments of any considerable size into the bladder; steel instruments could not be introduced at all. As the amount of organic contraction was so slight, and moreover was located in the musculo-membranous region, it did not seem advisable to perform any radical operation, particularly as urination was usually quite free and when it was not so the obstruction was readily relieved by anti-spasmodics and hot baths. I contented myself therefore, for a time, with the introduction of instruments up to the size of 24 French. I finally introduced an instrument of still larger size with considerable difficulty and with the production of severe pain, although very little force was employed. The bougie was allowed to remain in the canal for a few moments and upon its withdrawal, I found much to my surprise, that it was so deeply indented by the nipping produced by the slight organic contraction combined with the intense spasm of the muscles, as to render it worthless. In numerous other cases I have noticed this same indentation of a soft instrument to a less marked degree.

A case recently came under my observation of a physician in whom, although the urethra was apparently free from pronounced organic contraction and

would at intervals readily admit a No. 18 English sound, there would occur great irritation and spasm of the deep urethra coincidentally with indulgence in alcoholics and sexual excess. At such times I found it difficult to introduce a very small catheter into the bladder, although retention did not at any time occur. Irritable stricture of large calibre in a neurotic subject was the explanation of this case.

The association of spasmodic contraction of the deep urethral muscles with disease of the kidneys has not, as far as I am aware, attracted special attention. It is an element however, of the painful and frequent micturition incidental to nephritic colic, stone in the kidney and pyelitis. I have a case now under observation in which there was marked urinary obstruction coincidental with an acute exacerbation of pyelitis, although the urethra had previously been entirely free from obstruction. In such cases there may be associated with the reflex spasm, more or less neuralgic pain of a reflex character in the back, groins, hypogastrium and thighs. I of course recognize the fact, that in these cases there exists the special irritating factor of a morbid condition of the urine.

#### DIAGNOSIS OF SPASMODIC STRICTURE.

*The diagnosis of spasmodic stricture* is usually comparatively simple, particularly in those cases in which retention comes on suddenly. It is obvious that the sudden occurrence of retention in a case of organic stricture, or other obstructive lesion of the genito-urinary tract, in which the stream of urine has been previously only moderately lessened in size, must depend upon some complicating condition—either inflammation and congestion at the site of the organic lesion, spasmodic contraction of the cut-off muscle, or both conditions in combination. A certain degree of inflammation or congestion is to be inferred in every case of spasmodic retention of urine and requires due considera-

tion; the predominating element of spasm is, however, the principle feature. As a rule, in cases of sudden retention of this kind, there is a history of some one or more of the exciting causes which have been enumerated.

In determining the dependence of retention of urine upon spasm, it is necessary to remember that in by far the majority of cases there is some organic foundation for the condition. When, in the course of treatment for organic stricture of small calibre, retention suddenly occurs, the predominating condition is usually congestion or inflammation. The occurrence of acute urethritis during the course of marked organic stricture is apt to superinduce sudden retention. The condition in these cases,—although a spasmodic element exists,—is mainly congestion and inflammation at the site of the stricture, which produces sufficient swelling to completely close it for the time being. Urethritis produced by the introduction of instruments brings about retention in the same way. Cases of stricture of large calibre in which there is little or no obstruction to the passage of urine, may suddenly develop retention from spasm. *It is doubtful whether congestion or inflammation alone could produce closure of the canal in such cases.*

It is sometimes difficult to determine during instrumentation of the canal, how much of the obstruction to the passage of instruments is due to organic contraction, and how much to spasm. For example, after an instrument has passed a stricture of large calibre in the penile portion of the urethra, or an inflamed and irritable meatus, it will be found to be obstructed in many cases as it enters the membranous region. A steel instrument is less likely to be obstructed than a soft bulbous one, and the spasm is more likely to yield to steady and gentle pressure against it with the point of the sound than to a soft bulb. If there be organic contraction in slight degree at the bulbo-membranous junction, a steel instru-

ment small enough to pass the stricture in the anterior portion of the canal will, in all probability, slip by and fail to detect it. A large bulbous instrument will usually fail to pass altogether, but if a small bulbous bougie be introduced, it will be found that the spasm of the surrounding muscles, although insufficient to obstruct the passage of the instrument into the bladder, will at the same time pucker the stricture together so to speak, in such a manner that the shoulder of the instrument impinges upon it as it is withdrawn. *The peculiar feel imparted to the bougie and the sudden snap produced by the passage of its shoulder through the organic contraction, will determine the exact nature of the case.* Fig. 32 shows in conventional outline the *modus operandi* of the diagnosis of stricture with the *bougie à boule*.

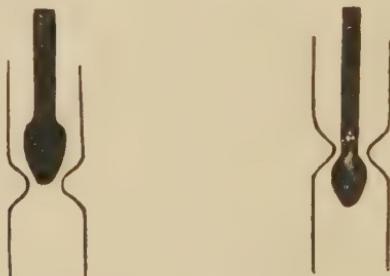


FIG. 32. (*After Culver and Hayden.*)

It will thus be seen that a comparatively small bulb may detect an organic contraction with predominating spasm in the deep urethra, where a very large steel sound would fail to perfectly outline it, or perhaps fail to detect it altogether. The peculiar sensation of elasticity imparted to the instrument as it impinges against the portion of the urethra which is spasmically contracted, will usually give an expert a tolerably accurate idea of the real condition of affairs. *On account of the spasm which is usually encountered, there are very few individuals indeed, in whom a stricture in the deep urethra cannot be demonstrated by the bulbous bougie. If, however, a very small instrument be passed, and carefully and slowly with-*

drawn, organic contraction may be readily excluded. The ordinary sound cannot be relied upon for a diagnosis.

There are some exceptional cases of chronic spasmodic stricture, in which the real condition can only be demonstrated by the subtraction of all sources of irritation, direct or reflex, after which the supposed organic stricture will disappear.

#### TREATMENT OF SPASMODIC STRICTURE.

Obviously, the first indication in the treatment of spasmodic stricture is to remove all predisposing causes as far as possible. Such conditions as the gouty and rheumatic diatheses require correction. General nervous irritability and hyperæsthesia may require nervine tonics, or sedatives and anti-spasmodics, or both, according to the special indications present. The principles of genito-urinary and sexual hygiene should be thoroughly impressed upon the mind of the patient. Once succeed in disabusing the patient's mind of the fallacious notion that his penis and testes constitute the axis around which his earthly existence revolves, and the surgery of the case is much simplified. Every possible source of local and reflex irritation must be removed. *This necessarily involves in the majority of cases the cure of organic lesions of the urethra.* The urine should be kept bland and non-irritating by dietetic measures and the administration of alkaline remedies. Careful study should be given in each case to the degree of tolerance of the urethra for instrumental manipulations. The amount of irritability of the urethra and the degree of spasm excited by the passage of instruments is a fair criterion of the frequency with which they should be introduced in the treatment of organic stricture.

When retention comes on as a consequence of spasmodic stricture, an attempt should be made to relieve the condition by derivation—with a view of re-

moving possible congestion—and by anti-spasmodics. The passage of instruments should be avoided if possible, as tending to increase irritation and spasm. The full hot bath, and morphia by the mouth or hypodermically should be depended upon as far as practicable. Very often the patient will succeed in passing urine while in the hot bath, which is both derivative and sedative. When it is found that these simpler measures fail to relieve, a small soft catheter should be carefully introduced—while the patient is in the bath if possible. If necessary, chloroform or ether may be given to the extent of full anaesthesia, for the purpose of relaxing the spasm and facilitating the passage of instruments. Whenever retention comes on in the course of organic stricture, it must be remembered that the accident is not due to the organic contraction *per se*, but to certain plus conditions, i. e., spasm, congestion and oedema of tissue in varying proportions. The relief of the retention depends upon the subtraction of these plus conditions from the primary predisposing factor of organic contraction. The treatment of urethrismus is chiefly operative. After all sources of reflex irritation have been removed, the urethrismus disappears.

#### CONGESTIVE OR INFLAMMATORY STRICTURE.

This is usually a complicating condition rather than a pathological entity, being much less frequently met with as a prime factor in the case than spasm. Even the rare existence of congestive and inflammatory stricture as an essential condition is denied by many surgeons, but it would at least appear to be the main feature of a minor proportion of cases of urinary obstruction, with or without retention. This congestive or inflammatory obstruction may occur (1), as the result of occlusion of the urethra by extensive infiltration of the mucous membrane, peri-urethral connective tissue and the corpus spongiosum, in severe or virulent urethritis; (2)

at the site of an injury to the mucous membrane produced by instrumental or accidental trauma from within or without the canal; (3) as a consequence of acute and virulent urethritis affecting strictures of large calibre\* or congested and granular patches of the mucous membrane.

Necessarily the most frequent variety of congestive or inflammatory stricture occurs in connection with organic stricture. It is often a difficult matter to determine in a particular case in exactly what relative proportion the elements of spasm and congestion exist.

Some cases of congestive stricture exhibit a marked tendency to bleeding, either as a consequence of instrumental interference, sexual indulgence, or in rare instances without apparent cause. I have noticed this symptom with especial frequency in syphilitics and in patients having a tendency to varices.

#### THE TREATMENT OF CONGESTIVE OR INFLAMMATORY STRICTURE.

The indications for treatment are the same as in spasmodic stricture—which is usually a complicating factor—with the exception that in cases in which it is believed to be a prominent element or the predominating condition, the application of leeches in the course of the urethra, particularly in the perineal region, is advisable.

# CHAPTER IV.

## ORGANIC STRICTURE.

### TRAUMATIC AND CONGENITAL STRICTURE—STRICTURE IN THE FEMALE—VARIETIES AND LOCATION OF ORGANIC STRICTURE.

*Organic, permanent or fibrous stricture* is that form in which the narrowing of the urethral calibre is due to an aggregation of organic tissue formation, and may be either congenital or acquired. It is most often acquired, and is most frequently met with between the ages of 24 and 45.

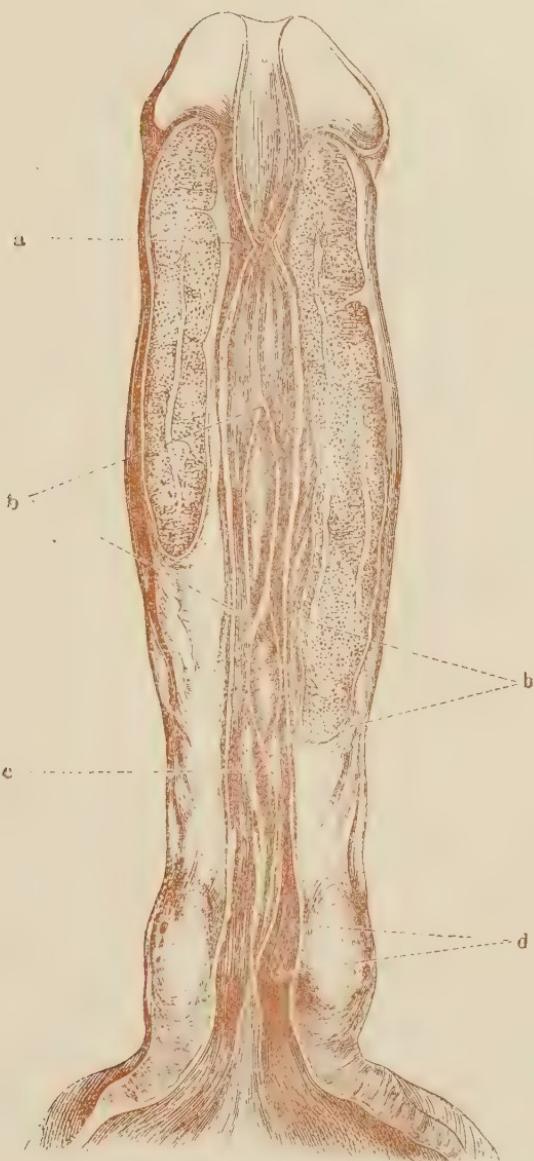
Very rarely indeed does a stricture give trouble for the first time after the age of 40. It may occur at any time after the period of puberty. The frequency of stricture between the ages mentioned is easily explained by the fact that it is at this period of the life of the individual that he is most subject to urethritis,—the most frequent cause of stricture.

#### TRAUMATIC STRICTURE.

*Traumatic organic stricture* may occur at any age. The youngest case which has come under my observation was a boy of 13, who was operated upon several years ago by the late Dr. Hodgen, of St. Louis, who performed an external perineal section. In this case the stricture recontracted,—probably from neglect on the part of the patient,—and is now with difficulty kept open. Another operation will eventually be required. Erichsen records a case of traumatic origin in a boy of 11 years of age.

Traumatic stricture is usually located at the triangular ligament. It is at this point that the

PLATE II.



MULTIPLE STRICTURE.

a, Annular Cicatricial Stricture; b, b, Dilated Portions of Urethra; c, Callous Peri-urethral Tissue at Point of Deep Stricture; d, Sinuses in pars Prostatica.  
*(After Dittel.)*



urethra is likely to be injured by blows or falls. A fall astride a hard object or a kick in the perineum is the usual cause. The bulbo-membranous urethra is caught between the impinging body and the sharp, knife-like lower border of the sub-pubic ligament, and a very slight degree of force may therefore produce permanent injury. It does not require a very great degree of violence to completely sever the urethra in this situation. The pendulous urethra, on the other hand, is rarely involved in traumatic stricture on account of the difficulty with which it can be caught between two impinging bodies.

No matter what the location of traumatic stricture may be, it is composed of cicatricial tissue, the extent of which depends upon the degree of destruction of the urethral walls, which has given rise to the stricture. Obviously such a stricture is the worst with which we have to deal. It is rarely amenable to dilatation, and usually requires a perineal section.

#### URETHRAL STRICTURE IN THE FEMALE.

It is obvious that the female sex enjoys relatively great immunity from stricture of the urethra. This is explicable by the shortness and simple structure of the canal and the extreme rarity of urethritis in the female. I have never seen but one case of the kind, and that occurred in a masturbator, probably as a consequence of laceration by the introduction of foreign bodies. Erichsen records a case occurring in a woman, but does not state the probable cause. Dr. Ely Van de Warker, however, has shown that stricture in the female is more frequent than is generally supposed, and has reported a number of interesting cases.\*

Otis has also asserted that stricture of the urethra is more often seen in women than is generally believed.† Symptoms, which in men would be at once attributed

\*Journal of Am. Med. Ass'n, 1890.

†Trans. Am. Ass'n of Andrology and Syphilology, 1891.

to a stricture of the urethra, are in women attributed off-hand to an irritable bladder. It has been asserted that stricture may occur in lithæmic female patients independently of any infectious or inflammatory process and may require the same treatment as in men.

#### CONGENITAL STRICTURE.

*The congenital form of stricture* is rare, if we exclude narrowing of the meatus. The existence of congenital stricture below a point one-fourth of an inch from the meatus is denied by the majority of surgical authorities. If, however, we take into consideration the occasional occurrence of congenital atresia of a part or the whole of the urethra, the possible occurrence of localized congenital narrowing of the canal seems logical. I have seen a number of cases of linear stricture of the pendulous portion of the canal which I believe to have been of congenital origin. One of my cases in particular was very striking. The stricture in this case was located at a point three inches within the meatus, and consisted of a thin membranous septum, imparting a sensation to the bulbous bougie as of a thin fibrous washer within the canal. This stricture was of large calibre and readily admitted a number 14 English sound. It was discovered accidentally during the passage of sounds for the relief of frequent nocturnal emissions. I had known the young man intimately since his childhood and am positive that the history given me of the absence of traumatic and inflammatory causes was a truthful one. It may be asserted that such cases are traumatic and due to masturbation. This I admit to be possible, yet I deny the probability of such an explanation in the case just described and in some others which I have seen. In speaking of cases of congenital stricture, points of slight contraction which may be demonstrated in nearly all subjects are not included.

*Congenital stricture of the meatus* is a relative affair, inasmuch as it is not *per se* productive of discomfort, in by far the majority of cases. An individual with a meatus narrower than the average is not likely to be annoyed thereby, providing he never contracts gonorrhœa.

As has already been said in the chapter on anatomy, there is a wide variation in the size of the meatus in different individuals, and there is very frequently not only a narrow meatus, but a distinct linear contraction of the canal about one-fourth of an inch within it. When a urethra with such an external orifice becomes affected by inflammation, or when it is found necessary from any cause whatever to explore the urethra or bladder, the meatus at once assumes a position of pathological importance, inasmuch as it is impossible to satisfactorily explore,—and more difficult, if possible, to thoroughly treat,—a urethra of moderately large calibre, if the meatus is narrow, even by the use of the urethrameter.

In order to determine the condition of the urethra, or to treat organic disease of the mucous membrane, the meatus must admit instruments of a size corresponding to the largest mean diameter of the canal. Obviously, when the normal calibre of the urethra is 38 French, it is impossible to satisfactorily explore or treat it, when the size of the meatus is only 30 French. Otis' urethrameter, in the hands of the expert, has obviated the difficulty of exploration in such cases, but it is by no means as satisfactory or as safe an instrument for routine exploration as the bulbous bougie. Whenever, therefore, there exists a suspicion of urethral, prostatic or bladder disease and the meatus is contracted, it should be enlarged by incision, to a sufficient size to admit an instrument which will thoroughly distend the canal.

In by no means exceptional instances a contracted meatus of congenital origin has been known to induce

reflex neurotic disturbances in very much the same manner as does a phimosed prepuce in some cases. Irritability of the bladder with frequent micturition, and perhaps other more suspicious symptoms of stone, have been known to arise from this cause. I have met with a number of cases of this character, and one more interesting still, in which atony of the bladder resulted. The connection between the vesical atony and the contraction of the meatus was demonstrated by the success which followed meatotomy.

A congenital narrowing of the meatus may be due, as already mentioned in connection with the anatomy of the urethra, to partial occlusion by a thin membranous septum at its inferior commissure, the fossa navicularis terminating in a pouch behind it. In others however, the narrowing seems to be due to exceptional thickness of the tissues of the glans below the meatus. In the first of these conditions the meatus may stretch easily when instruments are passed. In the latter, however, the introduction of an instrument of sufficient size to distend the meatus, produces spasm, in some cases of the entire canal and in any event of the cut-off muscle: It will be seen therefore, that it is not alone the size of the meatus which is important, but its dilatability and its degree of tolerance of instrumentation. Whenever, during the passage of an instrument, the meatus is drawn tightly about it in a thin white line, it is safe to conclude that that particular instrument cannot be introduced into the deep urethra without the exhibition of unwarrantable force.

#### VARIETIES OF ORGANIC STRICTURE.

*According to conformation*, organic acquired stricture occurs in four principal varieties, viz.: (1) The first and simplest form is known as the *linear stricture*, the obstruction corresponding to that which would be produced by tying a narrow cord about the canal.

The second variety is wider, and is known as the *annular* form, the condition being mechanically similar to that which would result from tying a flat band or piece of tape about the canal. (3) The third form,—which is divided by some authorities into several peculiar sub-varieties,—involves a considerable extent of the urethra in an irregular contraction, and is known as *tortuous stricture*. For practical purposes these three varieties are sufficiently distinctive.

As regards their clinical features—stricture may be described as (a) *simple* and readily dilatable; (b) *irritable*,—involving local hyperæsthesia and hyperæmia; (c) *resilient* or elastic; (d) *recurrent*. This classification necessarily depends largely upon the behavior of the stricture under treatment.

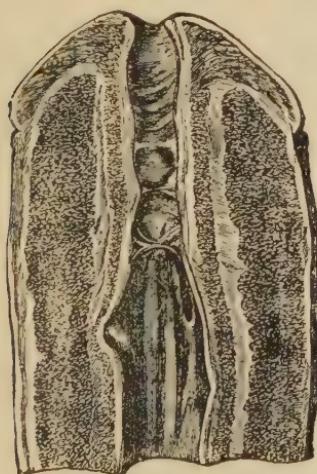


FIG. 34.

Linear Stricture in the Anterior Urethra. (After Voilemier.)

*Linear strictures* present themselves in several different forms. In some cases there exists one or more membranous septa occluding the canal to a greater or less extent. These are sometimes known as *bridle* or pack-thread strictures. There may be a number of these bridles, the orifices of which may or may not correspond. In some cases the bands are transverse, and in others oblique, in direction. Their orifices may correspond to the center of the canal, or may be located at one side. Occasionally the septum or band has a crescentic form, and involves only a portion of the canal.

The precise method of formation of these bridles and bands is open to question. It is not generally supposed that it is possible for inflammatory lymph to become exuded upon the surface of the mucous membrane. This ques-

tion would be difficult to settle, however, in the absence of abundant post-mortem evidences. *It may be accepted*

*as a possibility in cases in which the mucous membrane has been injured by instruments, or by chemical irritation.* The theory has been advanced that in some cases the bridles are due to the fusing together of the natural rugæ of the flaccid canal. In some instances the condition results from a tearing up of the valvular flaps of the mucous membrane by the careless introduction of instruments. In others it is possible that a certain

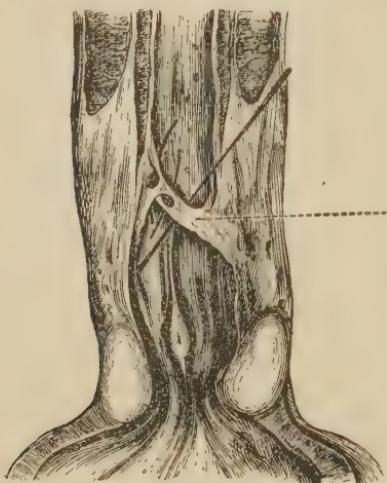


FIG. 35.

Irregular Stricture, showing Bands and Bridles.  
(After Dittel.) Bridle shown at B.

amount of atrophy of the submucous connective tissue and mucous follicles occurs, this giving rise to a loose flap of mucous membrane. That the natural folds of the mucous membrane may fuse together so to speak, and form part of a stricture mass, I firmly believe from conditions found in some cases of perineal section.

*Annular stricture* may be due to thickening of, and interstitial deposit in the mucous membrane, or to submucous inflammatory infiltration. I believe that in some instances of apparently annular stricture of large calibre—observed clinically—superficial thickening of the mucous membrane exists in the form of congested and granular plaques, at a point of normal relative inelasticity of the urethra. This lesion need not necessarily involve the entire circumference of the canal, although it apparently does so on account of the co-incident spasm, for just as soon as the bulbous bougie impinges upon such a sensitive spot, the urethra contracts down in front of

the shoulder of the instrument, giving the same sensation as it is withdrawn as would be imparted by a decided narrowing of the canal. Obviously it would be

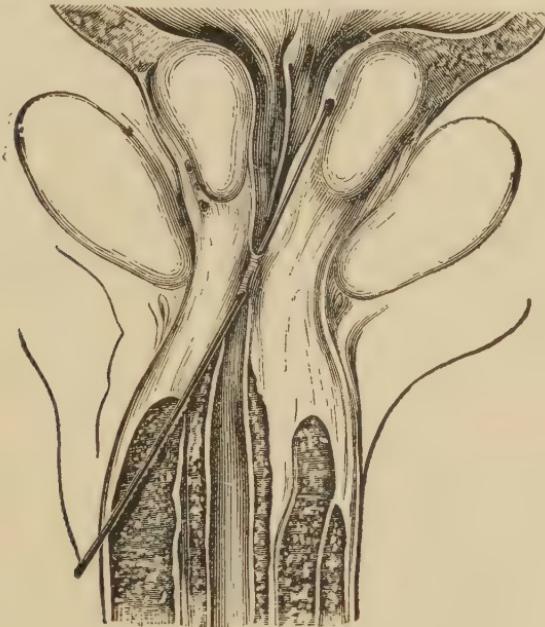


FIG. 36.

Typical Annular or Band-Like Stricture. (After Dittel.)

impossible to determine whether such a lesion involves the entire circumference of the canal or only a circumscribed patch.

*Tortuous strictures* are made to include all strictures above one-fourth to one-half an inch in width. They are irregularly contracted, *i. e.*, narrower at some points than at others, as a rule. The whole pendulous urethra may be involved, but always in a varying degree. The fact that an extensive tortuous stricture is narrower at certain points than at others is explicable upon the same grounds as the localization of congested and granular patches, and stricture of large calibre in the pendulous urethra, viz., the existence of normal points of relative inelasticity at which the inflammatory process is necessarily

*more aggravated than in other portions of the canal.* As already remarked, the formation of some tortuous strictures may perhaps be explained by the fusing together of the natural folds of the canal. If we admit the spiral or rifled form of the urethra in the flaccid condition of the penis, it is conceivable that pronounced infiltration of the corpus spongiosum may permanently fix it in its tortuous conformation.

*The number of strictures is variable.* It has most generally been accepted that stricture is usually single, but it will be found that in by far the majority of cases,—if the urethra be carefully explored,—more than one stricture exists. The surgeon who believes that a urethra which will admit a good-sized sound is necessarily free from stricture, is apt to recognize only the more marked cases occurring in the bulbo-membranous region, whereas if familiar with the occurrence of strictures of large calibre, he might discover by careful exploration in a given case, several strictures in the penile portion of the canal. Dr. Otis' investigations, while perhaps tending to slightly exaggerate the frequency and multiplicity of strictures, have certainly shown, not only that a stricture of large calibre may exist in cases in which the urethra will admit of a sound of good size, but that strictures of the pendulous urethra are much more frequently seen than has commonly been supposed. Some of the cases of so-called multiple stricture consist of irregular contractions of a long, tortuous stricture.

Dr. Otis relates a most interesting case of combined perineal and internal urethrotomy in which fourteen separate and distinct contractions were found by himself, and verified by other competent surgeons. In this case some of the strictures required several operations to complete the cure. The cut herewith presented (Fig. 37) shows the salient features of this case very clearly. In presenting this case before the New York Medical

Journal Association\* Dr. Otis demonstrated very clearly the diagnostic inaccuracy of the ordinary steel sound. No. 17 bulbous sound was first introduced by Professor

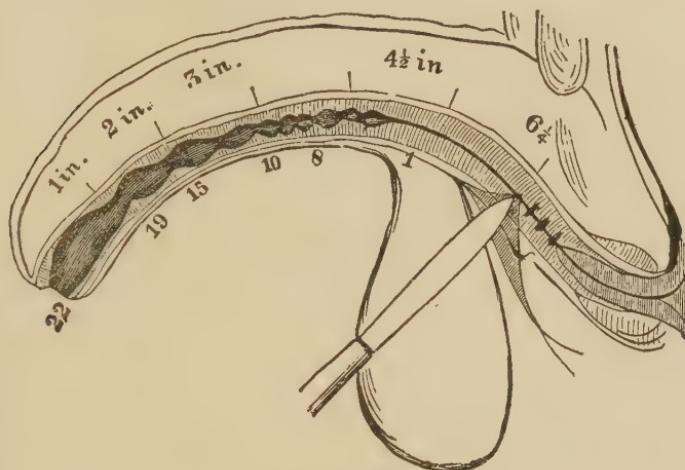


FIG. 37.  
Dr. Otis' Case of Multiple Stricture.

A. C. Post ; this was distinctly arrested at the points of stricture, at two and a half and two and three-quarter inches respectively. The obstructions were distinctly defined on withdrawal of the instrument, the result being confirmed by several other prominent surgeons. Dr. Otis then introduced without force and painlessly a 24 Fr. conical steel sound through the strictures into the bladder. No. 25 Fr. was then passed quite as easily. Dr. Otis directed the attention of the society especially to the fact that while a 17 bulb readily detected the strictures, a No. 25 Fr. sound absolutely failed to detect them.† There is no fact in urethral surgery so readily demonstrable as this, yet most physicians go right along in the old ruts, relying upon the sound for urethral exploration. And what is most exasperating is the fact that it is just such physicians, who perhaps have the confidence of the public and enjoy the

\*N. Y. Med. Journal, April, 1874.  
†Stricture of the Urethra. F. N. Otis.

patronage of a large *clientèle*, that are obstructionists in the way of intelligent urethral surgery. It is decidedly unpleasant to have a patient in whom strictures have been detected by accurate exploration, inform one that Dr. X states that no stricture exists, and that this has been demonstrated by the passage of a sound. Yet this is a sample of the experience of the expert specialist. The arbitrary and dogmatic opinions of the doctor whose *armamentarium* consists of a few sounds—and perhaps dirty ones at that, —are most pernicious in their influence upon the minds of the laity. To the layman, the situation often appears in a light by no means complimentary to the specialist, especially when,—as is often the case,—the general practitioner assures him that Dr. —— has suggested an operation or treatment of other kinds, merely for the sake of a fee. It does not seem possible that practitioners who pretend to be professional gentlemen could stoop to such means of self aggrandizement, yet such an experience has been the lot of many conscientious and competent men. So important do I consider this practical point, that I take great pains to demonstrate the relative diagnostic value of the sound and the exploring bulbs to my clinical classes.

*The amount of contraction* in cases of stricture varies greatly, between those of large calibre, in which there is but superficial thickening with loss of elasticity of the mucous membrane, and those severe forms of long-standing stricture in which the lumen of the urethra is so contracted as to resist the introduction of a fine bristle, even when the stricture is exposed post-mortem. The contraction is seldom sufficient to completely prevent the passage of urine. It has been claimed by excellent authorities, that in this sense, impermeable stricture does not exist. This, however, is probably incorrect, for it is conceivable that the urethra might be so completely destroyed from traumatism, that the resultant stricture

would close completely. The same is true of any organic stricture in case fistulæ form behind it and divert the urine from its normal channel. Erichsen says, nevertheless, that he has never seen or heard of a case of stricture which was completely impermeable to the passage of urine, even when fistulæ existed.\*

The explanation of the rarity of strictures impermeable to urine is a very simple one. Every intelligent practitioner knows how difficult it is to heal a fistula in the tissues which communicates with secreting structures, or a cavity containing materials which escape and enter the lesion. Urinary fistula, fistula in ano and salivary fistula are familiar illustrations. The patency of urethral stricture is not only facilitated by the passage of the urine, but also by the fact that the mucous membrane is usually intact—or at least in part. The inflammatory deposit, as a rule to which there are few exceptions, occurs in and beneath the mucous membrane, and produces obstruction by pressure upon it, instead of by fusing the opposing surfaces of the urethral walls together. Just so long as an intact strip of mucous membrane, however narrow, exists in the track of even the most tortuous stricture, just so long is it permeable—strictly speaking.

Strictures impermeable even to instruments are also very rare, particularly in the practice of surgeons who exhibit sufficient patience, gentleness and skill in instrumentation. *A stricture should not be pronounced impermeable because at one, or perhaps a dozen attempts it is found impossible to pass an instrument, for sooner or later,—particularly if appropriate general measures of treatment be instituted,—an instrument will usually be found to pass, and no matter how small it may be, the successful passage of a bougie at once gives the surgeon almost complete control of the case.* The most competent andrologist may fail to pass a stricture, but it must be remem-

\* "Science and Art of Surgery," vol. ii, p. 852.

bered that the impermeability of the stricture at one end of the bougie may mean a lack of tact or patience at the other.

#### THE LOCATION OF STRICTURE

*The location of stricture* has been the subject of much controversy. Dr. Otis' investigations in particular have modified in certain quarters the existing ideas of the relative frequency of stricture at different points in the urethra. That the views of Otis have not been allowed to pass unquestioned goes without the saying. The intellectual combat between Dr. Otis—at that time my superior in the genito-urinary service of the New York Charity Hospital—and my friend, the late Dr. Henry B. Sands, is one of the most vivid recollections of my hospital days.

Until recently the dicta of Sir Henry Thompson and others of his school have been universally accepted upon the location of stricture. Thompson found in 320 cases of stricture,—examined clinically,—212 which were located at the bulbo-membranous junction, 51 in the spongy portion of the canal, at variable points between one inch anterior to the opening of the triangular ligament, and  $2\frac{1}{2}$  inches posterior to the meatus, and 54 at the meatus or within  $2\frac{1}{2}$  inches posterior to it. In 270 cases examined post-mortem, he claimed a decided preponderance of stricture in the bulbo-membranous region, which he describes as the space included between a point one inch anterior to the triangular ligament, and another  $\frac{3}{4}$  of an inch posterior to it.\* H. Smith examined 98 preparations of stricture in the London Museums, and found only 21 in the membranous urethra, the other 77 being anterior to it. The majority of the latter were situated in the bulbous urethra or just in front of it. Otis claims, and I think correctly, that the condition is most frequently found in

\*"Stricture of the Urethra." Sir Henry Thompson.

the penile portion of the canal. It is obviously impossible for the Thompson and Otis schools to arrive at harmonious conclusions as long as their standards of stricture and methods of exploration remain so widely different. Post-mortem evidence is only relatively valuable. The surgeon who reasons from clinical experience and skillfully uses the urethrameter and bulbs, can never agree with Thompson, and must acknowledge the accuracy of Otis' methods, even though he may consider the conclusions of the latter somewhat overdrawn. It has been my experience that the most frequent site of stricture appears clinically to be at the meatus or just within it, most of these cases however being congenital. The next most frequent point is the junction of the bulb and fossa navicularis, or just posterior to it. *i. e.*,  $2\frac{1}{2}$  to 3 inches from the meatus. The next most frequent location is the bulbo-membranous junction and the next about one inch anterior to it. It seems to occur with varying frequency in the intermediary portions of the canal.

Otis found in 258 strictures 52 in the first  $\frac{1}{4}$  inch of the urethra; 63 in the next inch, *i. e.* from  $\frac{1}{4}$  to  $1\frac{3}{4}$  inches; 48 from  $1\frac{1}{4}$  to  $2\frac{1}{4}$ ; 48 from  $2\frac{1}{4}$  to  $3\frac{1}{4}$ ; 19 from  $3\frac{1}{4}$  to  $4\frac{1}{4}$ ; 14 from  $4\frac{1}{4}$  to  $5\frac{1}{4}$ ; 8 from  $5\frac{1}{4}$  to  $6\frac{1}{4}$ ; 6 from  $6\frac{1}{4}$  to  $7\frac{1}{4}$ \*.

In another series of 357 strictures only 5 were below 5 inches from the meatus. Bevan found that 89 per cent., or 399 strictures, in one of his own series, were anterior to  $4\frac{1}{2}$  inches.

As Otis remarks, it will be found that strictures occur, as might naturally be expected, with greatest frequency where the inflammation begins the earliest and rages the hottest, the frequency gradually diminishing in the deeper portions of the canal.

From a clinical standpoint I have come to regard stricture as any condition of the urethra which is capable

\*Stricture of the Urethra. \* 1882.

of producing friction, by obstructing the flow of urine — to however slight an extent—providing said obstruction and friction is productive of pathological disturbances, or —if the latter have already begun,—tends to perpetuate them. A point of normal contraction, or relative inelasticity, becomes a stricture only when the urethra assumes a pathological state; the previously normal lack of distensibility is then of great pathological and surgical importance, and its removal may be imperatively necessary.

No one who has not given this subject special study can realize the difficulty of forming an accurate estimate of the relative frequency of stricture in the various parts of the canal. The different standpoints of observation give widely varying results. As already indicated, Otis and Thompson can never be nearer together than they are to-day, unless both should accept the same standard as a criterion of stricture, and use the same methods of exploration and diagnosis. The Weir-Sands faction, with its normal points of contraction in the pendulous urethra, certainly cannot become reconciled to the teachings of Otis. I know of several excellent men with whom I have conversed, whose methods of reasoning are so widely apart that each stamps the other as an ignoramus. One begs the question, by accepting the views of Otis that a urethra should take a sound of a calibre proportionate to the dimensions of the penis, and the other entirely overlooks the question at issue, by the assertion that, "that kind of strictures can be found in healthy men." I once related a case of congenital stricture in the pendulous urethra to a prominent surgeon in this city, and he asserted that the patient could not possibly have a stricture if, as I said, he could take a thirteen English sound. I presume that there are many skillful men who would claim that a patient who can take a thirty to thirty-five French sound has no stricture Yet a patient

may take a forty French sound, and the case still demand urethrotomy. Number thirty may pass smoothly by an obstruction, which a number fifteen bulb will easily demonstrate.

Believing, as I do, that any point of contraction or inelasticity in the urethra, in the presence of a pathological condition of the mucous membrane, constitutes a stricture, I can unhesitatingly reiterate my firm conviction that stricture of the urethra is most frequent in the pendulous portion of the canal. If care be taken to exclude the element of deep urethrismus,—which exclusion is not as easy as some authors would have us believe,—the proportion is, I think, at least ten to one.

That great variance of opinion exists upon this point is well known, and Bumstead and Taylor long ago called attention to the fact that there could be no harmony of results between those who studied the subject upon the living and those whose estimates were formed entirely upon observations of the cadaver. Folet, in 1857, called attention to the frequency of fibrous stricture in the pendulous urethra, and its comparative rarity in the bulbo-membranous region. This author claimed that deep obstruction existed in all cases of stricture of the spongy portion, but that the deep stricture was nearly always spasmodic and secondary to the trouble in the anterior portion, of the canal. In 1866, Verneuil coolly appropriated Folet's thunder and expressed essentially the same views and in very nearly the same language. Otis, writing at a later period, while not so radical as his French predecessors, has promulgated similar views, but in a much more comprehensive and thorough manner. The relation of urethrismus to reflex irritation more or less remote, as shown by Otis, is one of our most important contributions to the literature of genito-urinary pathology, and is decidedly complimentary to the genius of American surgery.

In estimating the frequency with which deep spas-

modic stricture complicates obstruction in the pendulous urethra, an important source of fallacy exists, to which I will call attention, although at the risk of repetition of some points previously outlined: While a deep stricture may be demonstrated in nearly if not all cases, by instrumentation, it does not necessarily follow that such deep strictures exist at other times. A tender urethra resents a foreign body quite as vigorously as does the eye, and as soon as the sound touches a tender spot or sensitive stricture—even of large calibre—in the pendulous urethra, a pronounced reflex contraction is observable throughout the entire canal, which is of course, most pronounced in the deep portion. A spasm of the pendulous portion is not usually regarded as of importance; indeed, some surgeons discredit it altogether. I have found, however, that the spongy portion often contracts so firmly about the sound that it is felt to be firmly grasped during withdrawal all along the canal. This clonus in the pendulous urethra is of great assistance in diagnosis, as it serves to force diseased portions of the canal down in front of the shoulder of bulbous instruments of a calibre much smaller than the stricture will readily admit. Thus it often happens that a good-sized sound will pass by obstructions upon which quite small bulbs will catch.

In some cases, as already stated in the discussion of spasmodic stricture, deep spasm exists more or less constantly; but I believe that in many of these cases there is an actual organic change at the site of the spasmodic stricture; this may be true organic deposit, an erosion, or a congested and granular patch. Under such circumstances it is often very difficult to determine, even approximately, the proportionate relation of spasm to organic lesion. *Oftentimes the true condition of affairs can only be determined by subtracting the sources of reflex spasm in the anterior urethra by urethrotomy.*

The prostatic portion of the urethra is never in-

volved in true stricture so far as known. Thompson says on this point: "I may confidently assert that there is not a single case of stricture of the prostatic portion of the urethra to be found in any of the public museums of London, Edinburgh, or Paris."\*

*The immunity of the prostatic portion of the canal* is explicable from the following considerations: (1) Because of the rarity of extension of the acute inflammation to its mucous membrane; (2) Its distance from the primary point of infection and consequent exhaustion of the virus by the time the inflammatory process reaches the deep urethra. This gradual exhaustion of virulence is due to the resistance of the tissue elements—upon which resistance the inherent tendency of urethral inflammations to recovery depends. The gradual exhaustion of virulence of infectious processes as they travel downwards from the meatus cannot be disputed. (3) The close adherence of the mucous membrane to the muscular tissue of the prostate; (4) Perfect flushing of the mucous membrane during urination; (5) The constant barrier to the passage of poisonous secretions afforded by the contraction of the cut-off muscle; (6) A comparative degree of insusceptibility of the prostatic region to ordinary irritations and infections.

\*Thompson. Op. Cit.

# CHAPTER V.

## PATHOLOGICAL LOCALIZATION AND MORBID ANATOMY OF STRICTURE.

*The predilection of stricture for different portions of the canal* has not, it seems to me, been satisfactorily—or at least clearly—explained by the various authorities upon the subject. The explanation usually given for the relatively greater frequency of occurrence of stricture in various portions of the canal, more particularly in the bulbo-membranous region, is that there is in these situations a greater amount of the erectile tissue, and a more marked tendency to localization of inflammatory processes than in other portions of the canal.

There are several points to be considered in the explanation of the occurrence of stricture in any particular location, and in some instances there are certain special elements in its production which are worthy of attention.

Acquired strictures at, or just within the meatus are favored by the existence of congenital narrowing at this point. There is constant obstruction to the passage of urine and the friction thereby induced, inevitably enhances inflammation. There is, moreover, a tendency to pocketing of secretions behind it, and these secretions—primarily acrid in the case of virulent products of inflammation—are likely to decompose very speedily and aggravate the existing inflammation. The introduction of the nozzle of the ordinary syringe in injecting the urethra, necessarily produces considerable irritation when the meatus is very narrow. These considerations explain the frequency with which acquired stricture is

PLATE III.



Old Stricture of Pendulous Urethra showing Diverticula and Bands at Strictured Point  
with Diverticula of the Bladder. (*After Dittel.*)



found just within the meatus. Long nozzled syringes often produce stricture at a little distance within the meatus by the frequent impact of the point of the instrument against the inflamed mucous membrane. At such a spot of irritation the inflammation will necessarily become localized and chronic.

*The relative dilatation of the bulbous portion of the spongy urethra and of the fossa navicularis* undoubtedly favors the retention of a small quantity of urine and of pathological discharges at these points, but this element in the causation of stricture is not very important until actual obstruction by inflammatory thickening of the mucous membrane occurs just in front of the dilated point. Under ordinary circumstances these expanded portions of the urethra are thoroughly flushed out from time to time by the urine. When, however, stricture begins to form there will inevitably be a small quantity of decomposable fluid left in the canal in these situations. I think however, that this condition assumes little importance until the stricture becomes very thick, as the residual urine is not allowed to remain undisturbed for any great length of time. The urethra is relatively somewhat expanded just behind the juncture of the fossa navicularis with the spongy urethra, and at this point also similar conditions prevail.

*Strictures produced by injury to the canal during the passage of instruments* necessarily occur at the site of the lesion thereby produced. Inasmuch as the principal obstruction to the careless passage of instruments, even in the normal urethra, is found at the opening in the triangular ligament—i. e. the bulbo-membranous junction—it is at this point that such strictures are most apt to be found.

*Traumatic strictures* produced by falls and blows upon the urethra, correspond to the seat of the injury. It is very difficult however, to catch the pendulous urethra between two impinging bodies, unless it is done

with deliberate intent to produce injury. In the case of the deep or fixed urethra, however, injury is very readily produced by falls and blows upon the perineum. Strictures produced in this way occur most frequently at the bulbo-membranous junction, for, as already stated, this point corresponds with the opening in that tense, fibrous septum, the triangular ligament, and with the sharp lower border of the subpubic ligament; this latter structure is of a semi-cartilaginous consistency, and its edge is almost as firm and resisting as would be a narrow border of bone. It is between this hard tissue and the impinging body that the urethra is usually caught in injuries of the perineum, and it takes but slight force to produce sufficient injury to the canal to result in traumatic stricture. Comparatively slight force may sever the urethra completely. Injuries unnoticed in early life may later on produce organic stricture. These traumatic strictures are on the average the worst variety with which we have to deal.

*The location of strictures due to the introduction of strong chemical or caustic substances into the urethra,* may be determined by the same normal anatomical conditions, as in the case of ordinary virulent urethritis. They may, on the other hand, occur at the point chiefly affected by the caustic or chemical substance.

*Foreign bodies in the urethra* may produce localized inflammation—and perhaps ulceration—which determines the site of a subsequent stricture. Most often a foreign body lodges in one of the dilated portions of the canal. Under such circumstances the foreign material produces the most pressure and irritation, at that point in the mucous membrane at which its outward passage with the flow of urine is obstructed.

*Injury incidental to the occurrence of chordee,* is often responsible for the localization of stricture. This condition interferes with the normal distensibility and elasticity of the urethra, and during erection produces a

strain upon the tissues of the corpus spongiosum and the urethra at some particular point, or points. The point of greatest convexity of the curve produced by the chordee is, as a rule, the point at which the greatest strain is experienced. The irritation produced by this straining of the tissues is apt to induce the localization of stricture at this point. In some instances the corpus spongiosum or mucous membrane of the urethra yields to the tension and is lacerated to a greater or less extent. This may be produced by the patient forcibly bending the penis with the fatuous idea that rupture of the chordee will cure his gonorrhœa. I believe however, *that in marked cases it may result from frequent and vigorous erections, the occurrence of laceration being unrecognized, save perhaps in some cases in which the patient calls the attention of the surgeon to the fact that there has been more or less haemorrhage during the night as a result of the chordee.* The corpus spongiosum being inelastic, vigorous erections may produce slight traumatisms here and there in the canal in the absence of recognizable chordee. This, in my opinion, is a frequent cause of stricture. Under the circumstances mentioned the subsequent stricture occurs at the site of the injury of the tissues.

M. Desnos has recently called attention to slight traumatisms of the urethra during erection, as a cause of stricture.\* In my lectures for ten years past, I have claimed that slight injuries of the mucous membrane,—and perhaps, of the corpus spongiosum—frequently occur during urethritis, as a result of erections while the elasticity of the spongy urethra is impaired by plastic exudate. These injuries are, of course, most likely to occur if chordee be present, or if intercourse be attempted; but may happen when neither circumstance prevails. It is not necessary to "break the chordee" to produce them. Whenever any appreciable quantity of blood appears in a gonnorrhœal discharge, such minute tra-

\**Annales des Mal. des Organes Genito-Urinaires.*

matisms may be inferred. These slight injuries often form the groundwork for future stricture building.



FIG. 38. Casts of Supposedly Normal Urethrae. (After Sands.)

By far the most important element in the determination of stricture at special points in the urethra is, *the*

*existence of certain normal anatomical peculiarities of the structure of the canal.* These are the chief bone of contention among the warring factions whose *casus belli* is the question, to cut or not to cut. It has been shown by Weir, Sands and others that there are certain points of narrowing in the spongy portion of the canal which have been termed by them *normal contractions*, these being distinct from the normal points of contraction usually recognized, namely, the meatus, the bulbo-membranous junction and the point of union of the spongy urethra with the fossa navicularis. This description is, it appears to me, somewhat misleading. The urethra is an elastic tube susceptible of considerable dilatation. Its elasticity, however, is not uniform throughout, but as a consequence of sparsity of elastic tissue, with a preponderance of connective and fibrous tissue in the erectile structure of the corpus spongiosum, and a deficiency of areolar tissue beneath the mucus membrane, there exists at various points in the canal relative inelasticity and limited dilatability of the urethra.

It is well known that in certain portions of the canal relative inelasticity and limited dilatability, are due to certain anatomical peculiarities of the surrounding structures. For example, at the opening in the triangular ligament, the urethra is not only narrow, but is surrounded by dense and unyielding tissues. The meatus is comparatively inelastic in most individuals, even when it cannot be said to be congenitally contracted. The corpus spongiosum is a little thicker at the junction of the fossa novcularis with the spongy urethra and at the junction of the latter with the bulb. At these various points moreover the areolar tissue beneath the mucous membrane is disproportionately scanty and the latter is more closely applied to the tissues upon which it rests. It would seem also that, as there is normally more strain at these points of narrowing than at any other portion of the canal, the urethra is here rein-

forced by an increased density of fibro-connective tissue.

In explaining the localization of stricture, we will take as our point of departure the fact that the urethra is a dilatable tube, the elasticity of which varies at different points in the canal. Through this tube, water at a certain pressure and in a certain volume, is forced at more or less frequent intervals. Obviously, the greatest friction is produced at the various points of normal contraction and relative inelasticity. Against the strain and friction produced at these points nature has provided a certain amount of reinforcement of tissue, and under normal circumstances, with a healthy mucous membrane, this pressure and friction does not produce any injury. *When however the canal is inflamed, as in acute urethritis, its lumen and elasticity are decreased.* Urine is nevertheless pumped through the tube in as great a volume and with as great frequency as under normal circumstances, producing by its mechanical pressure, friction and chemical effects, considerable irritation, as is evidenced by the consequent pain and smarting. Obviously, the greatest amount of irritation from friction, chemical action and pressure occurs at the points of relative inelasticity of the canal, and as a consequence it is here that inflammation tends to localize itself, and persists,—perhaps long after the remainder of the mucous membrane has returned to a condition to a greater or less degree approximating the normal. This continual friction and irritation is interpreted by the controlling centers and nervous supply of the part as a demand for reparative material, and as a consequence there must inevitably be more or less plastic deposit at these points. *This plastic deposit is a conservative effort on the part of nature, to prevent injury by the increased strain and irritation and to secure physiological rest.* Unfortunately, however, this conservative process is in these instances misapplied, for if complete absorption does not occur, the exuded in-

flammatory material remains, organizes, contracts and constitutes a stricture.

The existence of the points of relative inelasticity referred to also explains abraded, congested and granular patches of the mucous membrane in all instances in which they are not due to the frequent contact of instruments. The relatively greater amount of friction at such points tends to produce abrasion of the mucous membrane and removal of its epithelium, more frequently than at any other parts of the urethra. Rapid removal and reformation of cells results in impaired vitality and a vicious habit of cell formation. This is one of the most important factors in chronic urethritis.

To sum up: *The process of formation of stricture may be illustrated by a rubber tube of delicate structure and small calibre, through which water is pumped in a certain volume at more or less frequent intervals, and at a certain degree of hydrostatic pressure.*

*If this tube be compressed at certain points, or if it be tied in such a manner that, although not compressed, it is prevented from distending perfectly under the strain of the water, it is easy to see that it is at the point of obstrucion that the tube is most apt to give way, or after a time, to wear out.* If the lumen of the tube be diminished, the volume of water that is poured through it remaining the same, the strain upon its texture at these points will be greatly increased and it will give way much sooner. When, as a consequence of localization of inflammation upon the surface of, and infiltration of the areolar tissue beneath the mucous membrane, it becomes less elastic, as is the case when congested and granular patches occur from any cause whatever, there exists the same relative inelasticity and obstruction, and as a consequence a deposition of young connective tissue with resulting formation of stricture is apt to occur sooner or later. The friction produced by the urine is the principal explanation for the steady increase in thickness

and contraction of organic strictures. The extent of the stricture deposit depends on the degree of strain and friction present.

The physiological and biological elements in the localization of stricture must not be forgotten,—the vicious habit of cell formation already alluded to is of great importance: In the course of acute urethritis, there is a tendency to rapid formation of epithelium of a low grade. This is a reparative, a conservative process, but unfortunately a certain biological law comes into play here, viz: *In inverse proportion to the degree of differentiation of cells is their rapidity of proliferation, and their tendency to degeneration.* The consequence of this law is an erosion at the point of friction, and secondarily, a plastic deposit to resist strain. Comment upon this is not necessary. The subsequent metamorphosis into fibro-connective tissue of this deposit is well known. In the pendulous urethra especially,—and probably, also in the fixed portion—the plastic deposit may absorb, but the friction remains and a gleet is often kept up. *The points of normal contraction and relative inelasticity have now become of pathological importance.*

Now, I wish to ask at this juncture, what difference it makes whether these points were primarily present in the canal as normal conditions or not, as regards their surgical relations from the standpoint of treatment. The question is not, whether they are adventitious, as claimed by Otis, or normal as claimed by Weir and Sands, but what are their relations to the abnormal state of the canal? I believe that the difference between the two conditions is one of degree and not of kind, and I can see no logic in the dispute on either side.

From what has been said, I think—contrary to the usual opinion—that the direct relation of stricture to the severity of the primary urethritis may be clearly seen.

It is a self evident proposition that if what I have said regarding the relation of stricture to friction be

true, the same holds good with relation to granular, congested and eroded patches in the canal. *I believe moreover, that within certain limits the indications for treatment may be the same.* In addition to the element of friction in producing stricture and other lesions of the urethra, I acknowledge a varying degree of importance of retained infectious and inflammatory products at points of narrowing

Regarding the importance of the element of friction, Otis says: "It is only necessary to establish the fact that the *normal resiliency* of the urethra is diminished at a given point, to prove that, during micturition a perturbation of the stream *must* occur at such point, even if it is not sufficient to attract attention in any way. Hence the slightest contractions assume an importance which could not be inferred from the apparent freedom from trouble in passing the urine. They establish a localized point of friction, and of necessity, an increased excitement in the vessels of the part, possibly only enough to disturb the complete elaboration of epithelial material, and to cause a shoddy deposit to take the place of the clear normal secretion, and this may occur with very slight, or without the least abnormal sensation being present. The presence of the mucoid shreds in the urine may be the only evidence of commencing trouble. But a permanent point of friction once established, greater than the natural conservative power of the surrounding parts is able to counter-balance, obstruction is increased by the natural aggregation of plastic material at the point of irritation. In this way the tendency to recovery is combatted and a permanent point of inflammatory action is established.

Thus the difficulty, which commenced simply as an obstruction to the resiliency of the urethral walls, progresses certainly and naturally, to the point of narrow-

ing, to a greater or less degree, the calibre of the urethral canal."\*

When the views of Dr. Otis first appeared, they gave rise to much opposition. Among those who most vigorously combatted the teachings of Otis, was my lamented friend, the late Henry B. Sands. Among other arguments, Dr. Sands presented some very carefully prepared casts of inferentially normal urethræ, which showed great variation of calibre. What strikes me as most peculiar was the controversy on the question of the normal or abnormal character of many of the penile strictures as diagnosed by Otis. Taking into consideration the purely mechanical effects of stricture of the urethra, it is difficult to understand how quibbling was possible. To illustrate this point we will select one of Dr. Sands' own cuts. (Fig. 38.) What difference in the results and in the line of treatment could be maintained between a gleet perpetuated by the normal points of friction in such urethræ, and a gleet perpetuated by acquired stricture? Sooner or later, true adventitious deposit occurs and the point of normal, relative indissensibility merges into an acquired neoplastic contraction. *Points of relative inelasticity or contraction and points of of acquired contraction may be precisely the same from a clinical standpoint, in the presence of a pathological condition of the mucous membrane.* The cure of the case demands their removal, independently of their origin.

\*Otis Op. Cit.



# CHAPTER VI.

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## MORBID ANATOMY OF STRICTURE.

When urethritis becomes localized at any point in the canal, there results an extension of the process to the sub-mucous tissue, if this has not already occurred, or there is an increase in a pre-existing peri-urethral thickening. As Finger, Halle, Wasserman and others have shown, this is due to a sub-mucous infiltration of embryonal cells which soon forms a zone of peri-urethral sclerosis, more or less dense. This may or may not at the beginning, comprise a distinct thickening of the corpus spongiosum. This process constitutes the *debut* of stricture, and is the condition most frequently detected by the bulbs or urethrameter in chronic urethritis. Obviously, it is upon the loss of elasticity at the affected point, that the detection of the lesion depends. The same loss of elasticity explains the symptoms and tendency to increasing growth of the stricture.

In some instances there will be found a slight thickening of the mucous membrane with little or no sub-mucous proliferation of connective tissue, the epithelium being more or less denuded and covered with muco-purulent secretion. The follicles of the urethra at this point are dilated, thickened and in a condition of hyper-secretion. When the process has gone a little further the mucous membrane is thickened, congested, and perhaps covered with fungous granulations at the diseased spot, and there is more or less infiltration and thickening of the submucous connective tissue and the structure of the corpus spongiosum. In the older and more pronounced cases the corpus spongiosum is extensively infiltrated and of a semi-cartilaginous consistency;

so dense may it become that perfect erection is impossible. The condition under such circumstances is really one of chronic interstitial inflammation of the corpus spongiosum, which acts precisely like a localized acute inflammation of the same tissue, in that it gives rise to chordee. Bridles or bands, or flaps of thickened mucous membrane may be found in different cases.

*The degree of occlusion of the lumen of the canal* is very variable. In some cases of stricture of large calibre, superficial infiltration and thickening of the mucous membrane is localized to a very small spot in the urethra—perhaps not involving the entire circumference of the canal—and its lumen is contracted but little if any. In the more severe forms, occlusion may be almost complete.

*The secondary results of stricture are chiefly incidental to the obstruction which it produces to the outflow of urine, and vary greatly in degree. In extreme instances, all the possible conditions incidental to urinary obstruction and chronic inflammation of the urinary way, have been found post-mortem.*

The urethra anterior to organic stricture may be somewhat contracted as a consequence of chronic inflammation of the mucous membrane, associated with comparative disuse. The stream of urine which passes through the stricture not being of sufficient size to perfectly dilate the anterior portion of the canal, contraction might naturally be expected. It has been said that the urethra anterior to a stricture is in rare cases dilated, I cannot see, however, how this could occur, unless possibly as a result of extensive atrophy of the sub-mucous follicles and connective tissue.

The obstruction to the flow of urine will necessarily first affect the urethra just posterior to the stricture. At the point the canal becomes more or less dilated, and in extreme cases thinned. As a consequence of interference with the wave of contraction of the accelerator urinæ

and compressor urethræ muscles produced by the plastic deposit constituting the stricture, in combination with the dilatation behind it, this part of the canal is never free from urine, a drop or so invariably remaining after the act of micturition; this residual urine, after the process is well advanced, decomposes and enhances the chronic inflammation already existing. The inflammation is still further enhanced by the friction of the urine, and in extreme cases by the straining efforts incidental to its expulsion. As a consequence of the inflammation there will be found at this point a muco-purulent secretion of pasty consistency. It is this secretion which constitutes the discharge in most cases of gleet incidental to stricture. As the urine passes over the part, the secretion, in combination with more or less desquamated epithelium, is rolled up in little thready filaments—*tripper faden*—and may be seen floating about in the urine if a bottle of that fluid be held up to the light. There may be considerable congestion of the mucous membrane, so that the secretion is sometimes mingled with more or less blood. This, in my experience, is especially apt to be the case in syphilitics.

As a result of urinary decomposition, there is likely to be found behind a tight stricture of long standing, a deposition of more or less earthy material, perhaps in the form of a small calculus. A small calculus of renal or vesical origin may become lodged at this point. In a recent perineal section I found a calculus as large as a marrowfat pea behind a tortuous stricture.

As the case advances the mucous membrane behind the obstruction becomes very thin and fragile, and perhaps ulcerated, and bye and bye, as a consequence of a straining effort during micturition, it gives way, and a drop or two of urine, mingled with the germ-laden decomposing secretions of the part, escapes into the peri-urethral cellular tissue. Abscess with inevitable fistula—or perhaps as a consequence of burrowing, a number of

fistulæ—and infiltration of urine with resultant sloughing and death, are possible or even probable results. Wherever such fluid as is extruded under such circumstances, comes in contact with cellular tissue, it inevitably destroys its vitality, with the results just mentioned. It resembles in its destructive effects upon cellular tissue, the poison of erysipelas; it produces, in short, a septic cellulitis.

The various glandular structures which open into the urethra posterior to organic stricture, are invariably affected to a greater or less extent in marked cases, by the urinary obstruction and mucous inflammation. Thus the urethral follicles, prostatic glands, Cowper's ducts, and the ejaculatory ducts, become dilated, thickened and inflamed,

as a consequence of frequent and straining efforts at micturition. Even in that portion of the canal anterior to the stricture, the various sinuses and follicles will be found to be dilated—sufficiently so in many cases to obstruct the passage of fine instruments. Dilatation of these follicles and ducts is due to their successive distension and evacuation by inflammatory products. The prostate is more or

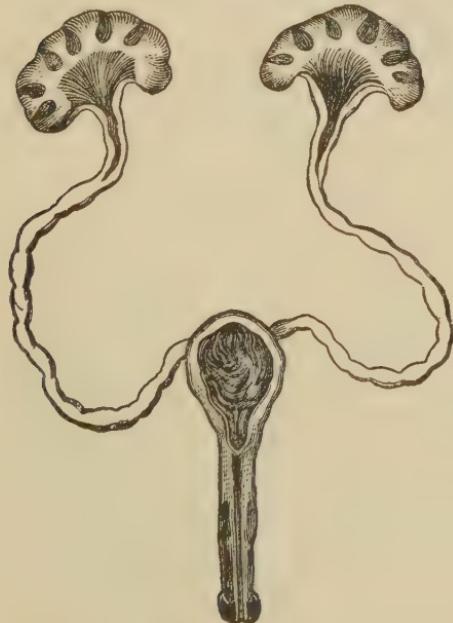


FIG. 40.

*Extreme Results of Organic Stricture of long standing, showing contracted and hypertrophied bladder, dilated ureters, dilated pelvis, and degenerated cortices of the kidneys. (After Keyes.)*

less congested and enlarged, as a result of the frequent bruising to which it is subjected in spasmodic and

difficult urination. It is possible that this condition of affairs, as seen in inflammation, congestion or neuralgia

of the vesical neck—with or without stricture—is one of the causes of enlarged prostate in advanced life.

The bladder is always more or less affected, even in strictures of moderate degree. As a result of the continual obstruction to the expulsion of urine, the detrusor urinæ muscles become hypertrophied. As the obstruction increases the viscus becomes dilated, and portions of its walls, where the bundles of

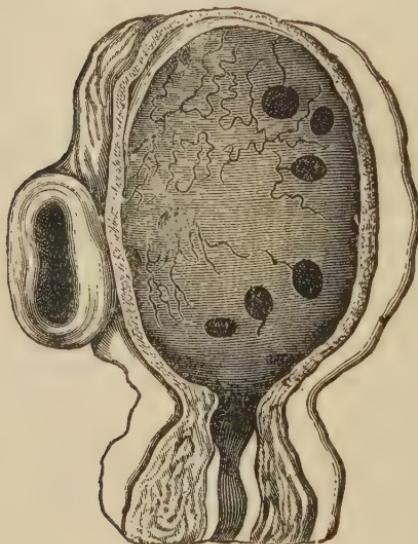


FIG. 41.

Showing the Results of Urinary Obstruction of Long Standing. (After Crosse.)

muscular fibres are deficient in quantity, become dilated and thinned, as a consequence of which condition sacculi are produced. In these sacculi urine collects and decomposes, and as a result calculi may form. In some rare instances the bladder, instead of being dilated, is enormously thickened from interstitial cystitis, and contracted so that it will hold but a very small quantity of urine.

The mucous membrane becomes affected by chronic inflammation and assumes a characteristic dusky or slaty hue. It is



FIG. 42.

Hypertrophy and Contraction of the Bladder from Stricture.

covered by muco-purulent secretions, mingled with sabulous material, and is usually greatly thickened, and perhaps rugose. Calculi may form in the bottom of the bladder, in the same manner as under other circumstances involving urinary obstruction.

Inflammation and dilatation of the ureters and the

pelves of the kidneys occur sooner or later in extreme cases. Pyelitis, with or without the formation of renal calculi, will be found to exist under such circumstances. Pyonephritic or peri-nephritic abscesses may occur. The secreting structure of the kidneys undergoes those changes, which are described under the omnibus term, —surgical kidney.

One of the characteristic conditions observed in surgical kidney is an interstitial proliferation of connective tissue and a deficiency of the elements of the



FIG. 43.

Extreme Results of Organic Stricture of Long Standing.  
(After Morris.)

normal stroma. Nature is very prodigal in her supply of reparative material to relieve strain, prevent

irritation or repair breaches of tissue. Obstruction to the urinary outflow, results in the accumulation of a physiological army of proliferating cells sent to the renal tissue or developed in *loco*, for the purpose of resisting a strain—which is interpreted by the trophic centers as a threatened breach of tissue. Unfortunately, this tissue reinforcement, as it organizes, develops no qualities of elasticity, and as the strain goes on, itself yields and enhances the process of passive dilatation. Moreover, it not only absorbs almost as rapidly as it is formed—after a certain point has been reached—but it displaces, strangulates and produces absorption of, the normal secreting elements of the renal glands.

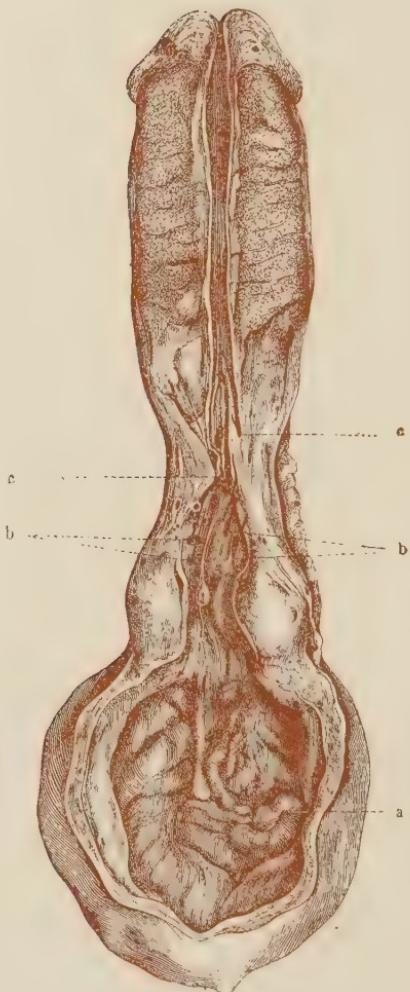
In some of the more distinctive types of surgical kidney, associated with pyelitis, pyelo-nephritis or pyo-nephrosis, we find disseminated suppurative foci in the secretory structure, i. e. the cortex of the kidney. These foci may form in two ways, viz.: by direct infection—by contiguity of tissue—or by indirect infection by pyæmic infarcts as a part of a general pyogenic septic infection. Whether this be due to ptomaines or to germs *per se* is not pertinent at this point.

In fatal cases of uræmia, following operations for stricture, the secreting structure is usually found to be remarkably congested and swollen from reflex hyperæmia, produced by the shock of operation.

It is to be remembered that these various consequences of stricture, which have been enumerated, are not due to any specific quality of the lesion, but are the typical results of extreme and prolonged conditions of obstructive disease of the genito-urinary tract, no matter what the cause may be. As far as stricture is concerned, we have possible pathological results sufficiently numerous and severe to convince the most skeptical, that through the medium of stricture, gonorrhœa is indeed a serious disease. The results of stricture, and the operations necessary for its cure, are often



PLATE IV



Showing extreme Contraction of a Stricture in a patient 19 years of age. a. Diverticulum of the Bladder. b. b. Dilatation of the Prostatic Ducts. c. c. False Passages.  
*(After Dittel.)*

directly fatal to life. It is this fact that makes gonorrhœa a much more dangerous disease than syphilis.

*The density of stricture* necessarily varies considerably according to the duration of the case, its origin, the habits of the patient, and the amount of irritation present. In old and pronounced cases it may be almost cartilaginous in consistency. Strictures of traumatic and chemical origin are very hard, from the simple fact that in them, a greater or less amount of the normal tissue has been completely destroyed and replaced by true cicatricial tissue.

## CHAPTER VII.

### CAUSES, SYMPTOMS, DIAGNOSIS AND PROGNOSIS OF STRICTURE.

*The most frequent cause of stricture is urethritis*, and it has been said that it is the duration rather than the severity of the inflammation which determines its occurrence; in other words, that a long continued inflammation of a low grade is the most usual cause. This, however, is open to question, for, while stricture results many times from chronic urethritis, it must be acknowledged that in the majority of instances the symptoms of chronic inflammation are dependent upon the stricture, and the stricture itself upon antecedent virulent inflammation—in brief, it is the stricture that causes a perpetuation of the inflammation and not the reverse. It may be rank heresy, but I believe that *it may be safely assumed that the danger of subsequent stricture, and of chronicity in urethritis, is directly proportionate to the severity of the acute inflammatory process.* Repeated attacks of inflammation almost inevitably lead sooner or later to organic stricture. It is rather exceptional—if indeed it occurs at all—that the urethra assumes its normal condition throughout its extent, for a long time after a virulent urethritis, as there exists in most instances, one or more damaged spots in the mucous membrane. In quite a proportion of instances these spots will sooner or later form a foundation for stricture; but they will inevitably do so, and in a comparatively short time, if the individual contracts a succession of attacks of gonorrhœa.

*Stricture may result from traumatism produced by instruments within the canal or by injury from without.* Severe injuries to the perineum usually involve the urethra. When they do so, they are inevitably followed, as already indicated, by the worst form of organic stricture. When the urethra is entirely cut across, or severely bruised, the loss of tissue is invariably replaced, as in other situations, by extensive cicatricial deposit. Indeed it is disproportionately dense, on account of the lack of rest incidental to urination and sexual excitement. This tissue contracts and constitutes a stricture. Injuries which were apparently trivial at the time, and have perhaps been long forgotten, are not infrequently the source of strictures the occurrence of which cannot be otherwise explained. It takes but little force to injure the deep urethra, and an accident which has produced apparently little or no injury is liable to affect the urethra sufficiently to develop stricture later on.

Injury to the perineal urethra may result from kicks, blows, and falls astride such objects as a wall or a fence. I have seen one case occurring in an athlete, as a consequence of falling astride a horizontal bar. Fracture of the pelvic bones has been known to produce traumatic stricture. Gunshot or stab wounds may produce it.

The forcible rupture of chordee superadds traumatism to the usual inflammatory causes of stricture. Careless instrumentation is often responsible for the occurrence of stricture. It is a very easy thing to force a catheter or sound through the urethral walls, or to produce sufficient injury by bruising and laceration to result in cicatricial deposit and consequent stricture.

*Cicatrices from chancre and chancroid, occurring at the meatus or within the urethra, may produce stricture.*

*Urethral injections* are popularly supposed to be responsible for a large proportion of cases of stricture, and this, it must be confessed, has some foundation in fact, for some surgeons, in their enthusiasm and desire for a speedy cure of their cases, are apt to forget that the urethra is lined by a very delicate mucous membrane, which is normally extremely sensitive to irritants, and is certainly more sensitive than ever when it is inflamed. Injections of a mild character, given in a proper manner, and at the proper period, will not produce stricture, but on the contrary, will tend to prevent it by their beneficial effect upon the inflamed membrane. The prejudice which usually exists in the minds of the laity regarding the use of injections is to be deplored, as the method is often a very useful one. Although the surgeon may sometimes be responsible for the occurrence of stricture, it is safe to say that in the majority of instances the disease is due to aggravation of the inflammation by a lack of rest, sexual indulgence or excitement, intemperance and self-treatment. The counter-prescribing in vogue among a certain class of druggists is often responsible for stricture. This is a matter which physicians would do well to take under advisement. There is no disease with which the counter-prescriber takes as many liberties as with gonorrhœa. The results are oftentimes very disastrous to the patient.

Independently of the strength of injections, it is to be remembered that the blandest of fluids may, when a urethritis is very acute, produce irritation by their mechanical action alone.

*It is probable that individual peculiarities exist in some instances as predisposing causes of stricture.* Thompson believes that heredity is a factor in its formation in some instances. His remarks upon the subject are as follows:

"In exceptional cases, from a constitutional indis-

position to terminate inflammatory action, this latter persists and produces a deposit which ends in stricture. This cause is not a speculative theory, for I am now satisfied that in certain families, individuals inherit a proclivity to the formation of stricture."\*

The theory that individuals in some families, present a marked tendency to connective tissue and fibrous thickenings in various situations, as a result of chronic inflammation, is a plausible one, yet it would be difficult in the majority of cases to trace the relation of heredity to stricture, and in any event the question is hardly a practical one.

Cachexiae of various kinds certainly act as predisposing causes of stricture, in so far as they tend to perpetuate and enhance the severity of inflammation, in whatever situation it may arise. I think it will be found that individuals with a syphilitic constitution are relatively more apt to develop stricture as a result of gonorrhœa, than other individuals. This is probably because a localized proliferation of syphilized cells is apt to occur at any point of local irritation which develops during the active course of syphilis. This is a practical point, as it is obvious that in such cases internal medication may be a very useful adjunct to strictly surgical measures. The same considerations apply to the existence of the gouty and rheumatic diatheses. Any condition which favors hyper-acidity of the urine, predisposes to stricture. Patients who are habitual drinkers are relatively more apt to develop stricture than are total abstainers. The constant ingestion of alcohol makes the tissues in general, irritable and prone to inflammation, both acute and chronic.

## SYMPTOMS OF STRICTURE.

*One of the earliest symptoms of stricture of the urethra is disturbance of the function of urination.*

\*Thompson. Op. Cit.

The decomposition of the small quantity of urine which collects behind the obstruction after the process has become moderately advanced, gives rise to organic compounds which are very irritating to the mucous membrane—as is evidenced by the chronic inflammation found at this point. This condition causes reflex or direct irritation of the neck of the bladder, with a resulting frequent desire to urinate. Some patients will first consult the surgeon regarding an increased frequency of micturition, possibly occurring only at night. Under normal circumstances the bladder will tolerate its contents during the hours of sleep, but in the presence of irritating affections of the genito urinary tract, it becomes intolerant of the urine and must therefore be frequently evacuated. It is not unusual to meet with patients who have been annoyed by several calls to urinate during the night for a number of years, but who have never been troubled in any other way by their stricture—which is, as a rule in such cases, of large calibre. Oftentimes such patients have a stricture at the meatus only. A stricture at the meatus may give rise to frequent urination by producing reflex irritation of the neck of the bladder, the rest of the urethra being free from disease.

A very frequent early symptom of stricture consists in dribbling of urine after micturition, when the patient supposes that he has thoroughly cleared the urethra of fluid. This is due to interference with the continuous wave of contraction of the accelerator urinæ and compressor urethræ muscles, the function of which is to expel the last few drops of urine or semen from the canal. As soon as the penis is allowed to hang downwards, the residual urine, or rather a portion of it, escapes and soils the clothing of the individual. It is not unusual, even in cases of stricture of quite large calibre, for imperfect ejaculation of semen to occur, with a similar dribbling of the fluid after the penis becomes flaccid.

This, I think, is chiefly due to reflex inhibition of the function of the urethral muscles.

The stream of urine may be forked, or twisted into a corkscrew fashion, according to the form of the stricture. In some instances, a straight stream will be projected from the meatus, while a second stream falls perpendicularly downwards. The size and form of the meatus modifies to a considerable extent the form of the stream, for in cases of stricture of large calibre, the meatus, if narrow, may counteract the effect of the obstruction and maintain the natural form of the stream. When the meatus is large and its lips turgid, the stream may present a fan shape, or there may be several streams running in different directions, very much after the fashion of the stream of water thrown from a garden sprinkler. This occurs in some persons who are free from stricture.

A little later on in the case the patient finds that more or less effort is required during the act of micturition, the abdominal muscles being unconsciously brought into play to supplement the action of the detrusor urinæ. As this condition of affairs goes on, more or less atony of the detrusor occurs, and a still greater effort is required to empty the bladder. So severe does the strain become in pronounced cases, that hæmorrhoids, prolapse of the rectum and marked turgescence of the prostate may occur.

After a time, as the case progresses, the stream of urine becomes extremely small, perhaps escaping a few drops at a time, and necessitating the devotion of considerable time to the act of urination. Ejaculation of semen may now be so interfered with that the fluid, instead of escaping into the vagina as under ordinary circumstances, is forced backwards, overcoming the resistance of the *veru montanum*, and passing into the bladder. If this condition of affairs lasts for a long time the function of the *veru montanum* may be inhibited

completely and permanently, so that the individual ever afterwards ejaculates the greater portion of the seminal discharge into his own bladder. Very often little or no semen will be discharged during the orgasm, for the reason that the increased turgescence of the corpus spongiosum, in conjunction with obstruction produced by the stricture, is sufficient to completely occlude the urethra during erection. The semen under such circumstances, instead of passing backwards into the bladder, may remain in the urethra to dribble away as soon as the organ becomes flaccid. Under such circumstances sterility is an inevitable consequence. Partial or complete impotency may result from stricture as a consequence of the local and reflex ennervating influence of the disease. In many instances the irritation of the stricture produces obstinate priapism and excessive desire.

*Neuroses from stricture:* While the majority of cases of stricture are unattended by pain of any kind, there is in quite a proportion of instances both direct and reflex symptoms of a painful character. Neuralgic pains in the groins or shooting up and down the spermatic cord, the front of the thighs and in the lumbar region are not unusual. Neuralgic pains in remote situations are occasionally experienced. I have met with numerous cases of this kind. One of my cases in particular was very interesting, in that an obstinately recurring angina pectoris was apparently cured by a urethrotomy for an irritable stricture.

The remote or direct nervous disturbances incidental to stricture of the urethra, are too often lost sight of in the strictly mechanical aspect of the condition. The decidedly complex relations of the genito-urinary apparatus to the sympathetic nervous system, should receive more attention than is usually accorded them. Our observations of the reflex neuroses from genital irritation in children, are a key to the solution of many

problems in the urethral pathology of the adult. There is a general impression that a stricture is of little importance unless it produces distinct symptoms of urinary obstruction. When, however, one meets with cases of vesical atony, incontinence of urine, impotency, neuralgia of the cord and testes, lumbo-hypogastric and lumbo-sacral neuralgia, profound mental depression and other neuroses, entirely and almost magically relieved by urethrotomy of strictures of large calibre, the importance of this question is brought before him in a very forcible manner. The relation of such conditions to congenital or acquired stricture at or near the meatus, is especially marked.

General malnutrition, hypochondria and malaise are often complained of in stricture. Nervous irritability is often a prominent feature of the case. Local pain referred to the neck of the bladder, rectum, perineum and hypogastrium are often experienced.

As the morbid tissue of the stricture increases in amount and density, it becomes more irritable, and attacks of complete retention of urine are apt to occur as a consequence of spasm of the urethral and cut-off muscles, with or without congestion or inflammation at the site of the stricture. There may be in such cases acute cystitis as a complication. The plus conditions which cause retention of urine are usually superinduced by sexual excesses, intemperance or exposure to wet and cold, often in combination with the dietetic excesses. Gouty and rheumatic patients are especially liable to retention. As a consequence of retention rupture of the urethra behind the stricture, or even rupture of the bladder may occur, the urethra being however, most apt to give way.

Following an attack of retention, acute cystitis may develop. The danger of this complication, however, depends to a great extent upon the degree of care exer-

cised by the surgeon in relieving the distended bladder. Infection and traumatism are very easily produced.

*Toxæmia from Stricture.*—The relations of stricture to uræmia—so-called—is not a new theme. Something will be said later on regarding the relation of the shock from surgical operations upon the urethra to toxæmia and consequent urethral fever; the subject is too comprehensive for discussion at this point.

The relation of absorption of ptomaines from the site of the lesion in stricture—or from behind it—to the general results of stricture, is unquestionably of great importance. The rapidity with which many constitutional symptoms disappear after cure of deep strictures, is thus easily explained. Urethral chill following instrumentation is also explicable in the same way in some cases.

The possibility of mixed infection must be taken into consideration. The cases of cystitis, epididymitis, peri-urethral phlegmon, pyelo-nephritis and other special phenomena secondary to stricture, are not all dependent upon direct extension of inflammation, but are probably due in many cases to secondary infection. A recent case of my own is strongly suggestive in this regard. A patient whom I was treating by dilatation for several irritable strictures of comparatively large calibre, developed multiple nephritic and perinephritic abscesses during the course of treatment. An interesting point was the fact, that the formation of the abscesses was heralded by great increase of irritability and spasm in the deep urethra.

The point which I desire to urge most strongly is the apparent fact that all patients with serious strictures—particularly of the deep urethra—suffer from a greater or less degree of toxæmia, and that many cases develop secondary single or multiple infections of one kind or another.

That the passage of instruments may precipitate toxæmia is granted. The danger is enhanced by uncleanliness, but strictly aseptic instruments may cause trouble. It is a question however, whether any instrument passed through a diseased anterior urethra can be aseptic by the time it reaches the deeper portions of the canal. It is my firm conviction that strictly aseptic surgery of the urethra would demand a flushing out of the canal prior to the introduction of even an ordinary sound. This, we know, is not ordinarily done, nor is it always practicable. We are most of us, therefore, committing cardinal sins from the standpoint of aseptic surgery as a matter of routine.

The various complications and sequelæ of stricture produce special and characteristic modifications of the symptomatology and course of the disease. Thus there may occur a special set of symptoms dependent upon prostatic inflammation and abscess, vesical and peri-vesical inflammation, urethral rupture with infiltration of urine, and the various renal complications which so frequently occur in the course of stricture.

#### THE DIAGNOSIS OF ORGANIC STRICTURE.

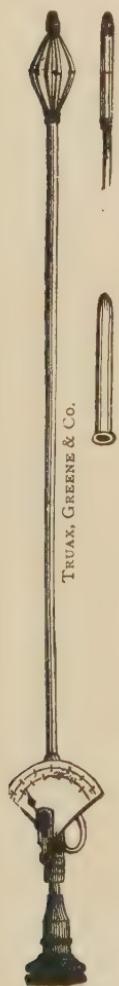
*The diagnosis of organic stricture* can only be made by instrumental exploration of the canal. The facility of examination depends upon the condition of the meatus to a great extent. It is obvious that with ordinary instruments a thorough exploration cannot be made through a narrow meatus. For example, if the canal be very large, its extreme capacity being 45 French, and stricture exists at different points, the canal being contracted at one or more of them to a diameter of 30 French, the condition cannot be readily detected through a meatus of a calibre of 20. Dr. Otis has devised an instrument, which has become very familiar to American surgeons, for the purpose of overcoming the obstacle afforded by a narrow meatus. This

instrument—the *urethrameter*—consists of a series of blades, operated by a thumb-screw, and connected with a scale-plate or dial, with an indicator which shows the exact degree of expansion of the blades as represented by the French scale, when separated at different points

in the course of the canal. This instrument is especially useful when an accurate record of cases is to be kept.

With the soft bulbous bougie, it is possible to accomplish almost as much from a practical standpoint as with the urethrameter. After a preliminary meatotomy the canal may be explored with a series of such bougies about as accurately, and perhaps on the average more intelligently and safely, than with the urethrameter. Incision of the meatus is devoid of danger if properly done, and is almost invariably beneficial in cases in which symptoms of genito-urinary irritation exist, whether stricture be present or not. I have, however, seen one case in the practice of another surgeon in which considerable sloughing followed meatotomy. This was unquestionably due to instrumental sepsis. The danger of injury by the urethrameter may be obviated to a great extent, by covering the end of the instrument with a thin sheath of rubber; this does not usually interfere with the separation of the blades, but does prevent the falling of the mucous membrane between them. With some patterns of the urethrameter and when the rubber sheath is thick, the blades of the instrument are apt to twist, corkscrew fashion, as they are opened.\* A valid objection to the urethrameter, is that by its use, strictures of large

FIG. 44.  
Otis' Improved  
Urethrameter.



\*The urethrameters of more recent construction have stouter blades which are jointed at the center of their convexities: This is a great improvement.

calibre can be found in every urethra at points of normal contraction. Some nicety of judgment is therefore necessary in estimating the points of narrowing demonstrated by the urethrameter at their true value. I believe that in quite a large proportion of healthy urethræ strictures may be detected with the urethrameter if Dr.

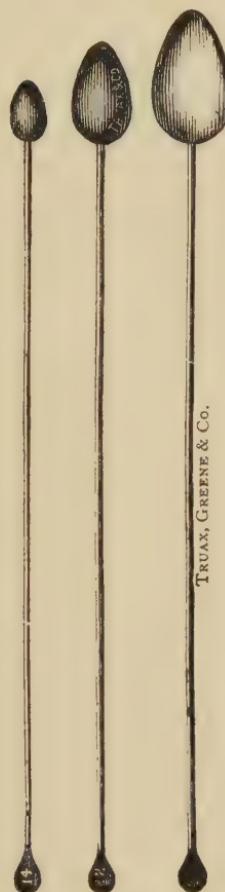


FIG. 46.

Otis' Bulb Sounds,

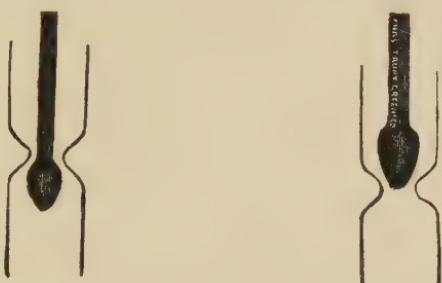


FIG. 45.

Bulbous Bougie at a Stricture. (Culver-Hayden.)

Otis' method of examination is too arbitrarily followed. This objection of course falls to the ground in cases in which there is a more or less definite relation between the points of narrowing and existing pathological conditions. In such cases it makes little or no difference whether the points of narrowing were once physiological or not; they have assumed pathological importance even though they be not of pathological origin.

*Meatotomy should be considered a necessary preliminary in both the diagnosis and treatment of urethral disease in any case in which the meatus is not of sufficient calibre to admit an instrument measuring from 30 Fr, upwards.* Some latitude, however, must be allowed, the size of

the penis being taken into especial consideration. Dr. Otis adopts as his criterion of the normal size of the canal the circumferential measurement of the penis in its flaccid condition, believing that there is a constant relation between the size of this organ the calibre of the urethra. This is probably true within certain limits, but the size of the organ is so variable at different times that it seems to me hardly safe to adopt this as an arbitrary rule. The mental effects of simple sounding often cause the penis to shrink to very small dimensions. I have had patients who claimed that the very idea of exposing the organ, was sufficient to produce this temporary shriv-

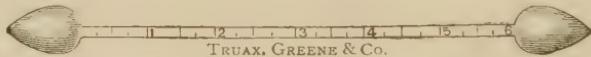


FIG. 47.  
Weiss' Bougie a Boule. (Ruled Staff.)



FIG. 48.  
Guyon's Bougie a Boule.

elling. In incising the meatus, due deference should be paid to its form. When the orifice is situated low down upon the extremity of the glans, it cannot be incised so widely as when it is located higher up, and as a rule it will be found that the lower its situation, the more distensible it is apt to be, and the less frequently does it require incision. When practicable, the orifice should be cut larger than the size which it is desirable for it to retain permanently, as some cicatricial contraction is inevitable. Dr. Otis' scale showing the normal size of the urethra is practically as follows: A penis measuring 3 inches in circumference should have a urethra of a calibre of 30 Fr. For each  $\frac{1}{4}$  inch of circumference 2 m. m. is added to the calibre of the urethra;—thus 3 $\frac{1}{4}$  in. = 32 Fr., 3 $\frac{1}{2}$  in. = 34 Fr., 3 $\frac{3}{4}$  = 36 Fr., 4 in. = 38 Fr., 4 $\frac{1}{4}$  in. and over, = 40 Fr.

Several instruments have been devised for meatotomy, the most familiar being the *bistouri cache* of Civiale.

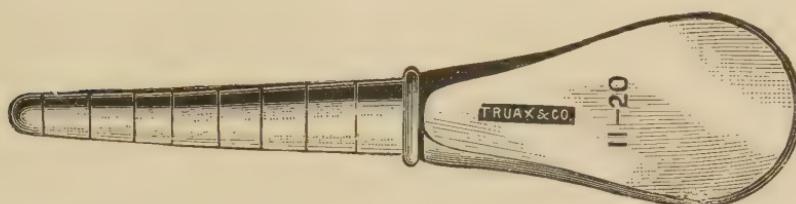


FIG. 49. Piffard's Meatometer.

This instrument is composed of two blades, one cutting and the other blunt, separable by means of a screw. Hav-



FIG. 50. Civiale's Meatatome (*Bistouri Cache.*)

ing been introduced for a sufficient distance within the meatus, the blades are separated to the required extent and the instrument is withdrawn, incising on the way the inferior commissure of the meatus. With this instrument more cutting is apt to be done than is intended, and it is to say the least, a bunglesome device for the performance of a very simple operation. A straight backed, probe pointed, narrow bistoury, such as that of Dr. Piffard, is the best instrument for this purpose, and in expert hands an ordinary scalpel will do in lieu of a special instrument; the scalpel may be used in combination with a director, or its point may be covered with a bit of wax, thus preventing accidental injury to the canal. The incision should be made directly down-



FIG. 51. Piffard's Metotome.

wards, care being taken not to cut through the floor of the urethra. Under cocaine the operation may be made perfectly painless. A 4 per cent. solution in water or an 8 per cent. oleate, may be injected into the canal by

means of a drop syringe, and retained for about five minutes, at the end of which time the part will usually be well anæsthetized. The hæmorrhage following meatotomy is sometimes considerable. I have experienced more trouble in this respect since using cocaine than formerly. The drug not only produces local anæsthesia, but also appears to produce vaso-motor paresis and venous congestion; the escaping blood will be found to be dark and of a more venous hue than under ordinary circumstances. Severe bleeding is not usual, however, at the time of the operation, as the drug seems to act primarily to a certain degree as an astringent. The next act of urination, however, after the astringent effect of the drug has passed off, is apt to be attended by considerable bleeding. If oozing is obstinate at the time of operation much time may be saved by plugging the meatus; for this purpose I use a wedge shaped piece of dentist's spunk. This is prepared by saturating it in a solution of bichloride of mercury, 1-500, and drying. This substance swells somewhat when it is wet and plugs the meatus sufficiently to check the bleeding. Should it escape at the next act of urination, as it is apt to do, the patient should be instructed to pinch the under surface of the glans at the site of the incision, with the thumb and finger, until the bleeding is arrested. Dangerous loss of blood cannot occur if this be done, and the pressure will usually check the hæmorrhage within a few moments. If the patient be nervous and excitable, he may become frightened by the occurrence of hæmorrhage, and losing his presence of mind, may not apply the pressure properly, as a consequence of which considerable loss of blood results. An instance of this kind occurred in my own practice, in which sufficient blood was lost to induce syncope. In this case I was obliged to introduce a small sponge-tent, before I could finally check the bleeding. Aside from the trifling danger of hæmorrhage of this character, I have never seen any unto-

ward results from meatotomy, excepting in the instance already mentioned in which a patient operated upon by one of my friends, suffered from sloughing of a portion of the glans about the incision. Such accidents may be avoided by strict asepsis. The meatus should be dilated every day or two with a full sized sound, for about two weeks, to prevent its growing together. Stitching of the edges of the quasi-mucous covering of the glans and the mucous lining of the urethra together, has been suggested for the purpose of insuring the patency of the meatus, and is often of value. I have frequently practiced this with advantage. This is not usually necessary, however, if proper attention be paid to dilatation during the process of healing.

If meatotomy is a preliminary to treatment by dilatation, it is well to wait until the incision has healed before treating the deeper parts of the urethra. Exploration or internal urethrotomy may, however, be completed at the same operation. When the patient cannot visit the surgeon frequently, a loop of wire or a hair pin may be bent to the required size and passed into the meatus several times daily for the purpose of keeping it open. Careful stitching of the cut edges is also of service under these circumstances.

Dr. Keyes states that dilatation after meatotomy is not necessary, even going so far as to say that: "A meatus properly cut remains open indefinitely, without the necessity of dilatation."\* I do not know what this distinguished surgeon means by the term "properly cut" as I am not aware that he has any special method of operation, and moreover, I have found that in almost every instance when the meatus has been incised in the manner which I have considered proper and have already outlined, the cut surfaces have almost invariably found to be adherent upon the following day. In fact, union by first intention often occurs, and mere separa-

\*Revision of Van Buren and Keyes, p. 154.

tion of the adherent lips of the wound is sufficient to cause quite free haemorrhage.

In some cases the frænum preputii is attached so far forward that a proper meatotomy cannot be performed. In such cases the frænum should be cut away in such a manner as to leave a clear field for the incision of the meatus.

Regarding the possible injury which has been ignorantly alleged to result from meatotomy, I will take occasion to say at this juncture, that meatotomy, properly performed, is never productive of untoward results. I am thus emphatic because the fine ethical sense of several of my professional brethren has impelled them to remark to patients upon whom I had performed the operation, that it was an injury to the organ. Whether pitiful ignorance or a less admirable quality actuates such men is of little consequence,—their statements are absolutely false. Experiences of this kind are constantly occurring in the career of the conscientious surgeon, and he is fortunate if he can regard them philosophically.

*Aside from the mere fact of the existence of obstruction in the course of the canal, there are several other points which may be determined by expert exploration; this implies exploration by the urethrameter or bulbs, the ordinary sound being relatively worthless.*

1.—It is obvious that the degree of contraction or calibre of the stricture is quite readily determined

2.—By careful measurements the distance of the stricture from the meatus can be quite accurately estimated.

3.—If the bulbous bougie or urethrameter be passed beyond the stricture and then withdrawn until it is caught, the distance of the posterior surface of the obstruction from the meatus may be determined

4.—The space included between the two measurements corresponds very nearly to the width of the stricture.

5.—The number of strictures is determined with only moderate facility with the bulbs, for the reason that the obstruction in the anterior portion of the canal may be sufficiently small to prevent the introduction of an instrument large enough to impinge upon the deeper strictures. This does not apply to the urethrameter, except in very tight strictures of the pendulous portion.

6.—The condition of the urethra behind the stricture may be approximately determined by examining the secretion withdrawn from the canal by the shoulder of the instrument. When this is thick, with a preponderance of purulent qualities, and containing sabulous material, a relatively pronounced degree of chronic inflammation may be inferred to be present. When there is little or no secretion, or when such as is present is of a mucoid character, the stricture may be inferred to be in a moderately passive condition, and the urethra behind it to be comparatively healthy.

7.—The amount of congestion present at the site of stricture may sometimes be estimated. When blood appears upon the shoulder of the instrument, or escapes from the urethra after its withdrawal—the exploration having been conducted with gentleness—a considerable degree of congestion at the site of the stricture is evidently present,

8.—Resiliency or irritability of the stricture may be determined. Resiliency or elasticity of the stricture is shown by the ready passage of a comparatively large sound, whereas the bulb of a much smaller bougie is obstructed. Irritability is demonstrated by the pain and spasm excited by the exploration and the subsequent occurrence of urethral chill.

After the exploration of the urethra for the first time, ten grains of quinia in combination with one-quarter of a grain of morphia should be administered to obviate a possible chill and urethral fever. Dr. Keyes

advocates the use of diuretin in meeting this indication.\* Should the patient be very sensitive or the stricture a severe one, it may be well to administer a drachm of the fluid extract of jabarandi or a hypodermic of  $\frac{1}{6}$  to  $\frac{1}{3}$  of a grain of pilocarpine. On account of their derivative and eliminant effects these drugs are very useful, particularly in cases in which uræmia is to be apprehended on account of the existence of marked renal disease.

The patient should be advised of the probability of severe smarting and perhaps pain at the next act of micturition, and also of the possibility of an increase of urethral discharge, or its appearance if it does not already exist. Alkaline diluents, the balsams, and—if the stricture be severe with complicating cystitis—boric acid should be administered. No further meddling is admissible for several days after the exploration. Should urethral discharge be free, however, mild bi-chloride injections are admissible.

#### PROGNOSIS OF STRICTURE,

*The prognosis of stricture involves two considerations : (1) Its curability, and (2) its danger to life.*

The possibility of a radical cure for stricture is disputed by the majority of surgeons; indeed the general opinion up to a recent date has been to the effect that without continual attention, a stricture once formed, will sooner or later give the patient trouble, no matter how skillfully, or indeed how successfully, his case may appear to have been treated. For example, it has been supposed that, as a rule, an individual who has been apparently cured of stricture during early adult life will again be troubled by the disease as he approaches middle age, unless he has in the meantime carried out more or less perfectly, treatment by dilatation—the necessity for which increases with advancing age. Were it not

\*E. L. Keyes. Op. Cit.

for the labors of Dr. Otis and his disciples, this old-time belief would probably never have been disputed, *but through the labors of these investigators it has been shown that quite a proportion of radical cures of stricture may be attained by the Otis operation of dilating urethrotomy, always providing such strictures are located in the pendulous portion of the urethra.* No system of treatment that has yet been devised has been conclusively shown to produce a permanent cure of stricture of the fixed urethra, with the possible exception of a few cases of perineal section. It has been held to be questionable in some quarters whether even those strictures which occur in the penile portion of the canal have ever been radically cured, but as many cases which have been operated upon by the Otis method have been examined upwards of 15 years after operation, and have been found to remain perfectly free from a recurrence of the trouble, as is shown by careful urethrametry, it is fair to assume that in such cases a radical cure has resulted. I base this opinion not alone upon the claims of Otis and his school, but upon thirteen years experience with the operation and a number of cases reaching well up into the hundreds. This point will be expatiated upon in the discussion of urethrotomy. I do not think that in the instances of apparent cure by various methods in cases in which the disease recurs sooner or later, the canal if examined, would be found to be free from obstruction for any great length of time during the interim. If re-contraction occurs after complete dilatation, rupture or division of a stricture, such recurrence is probably discoverable by thorough exploration within a very short time after the cessation of treatment. Indeed, I think it will be found on careful exploration *that re-contraction, if it occurs at all, has usually begun within the first year following an apparent cure.* For example, an individual who at the age of 40 presents evidences of re-contraction of a stricture which was apparently cured

some years before, if examined during the interim, would have been found to have a certain degree of narrowing of the canal, if thoroughly explored by the bulbous bougie or urethrameter. There are very few cases indeed in which re-contraction does not commence within six months after cessation of treatment; but this re-contraction, may progress very slowly or come to a standstill until some years have elapsed. At any time during this period however, marked and rapid re-contraction may occur as a consequence of acute or subacute inflammation excited by intemperance or sexual excesses. A recurrence of stricture occurs much more readily in cachetic, strumous, gouty, rheumatic and syphilitic patients than in those of a perfectly healthy constitution. *Necessarily the habits of the patient have much to do with his prospects of immunity from a recurrence of the disease.*

It may be formulated as a practical rule, (1) that traumatic or chemical strictures invariably recur, no matter what form of treatment may be instituted. (2) That chronic inflammatory strictures of the deep urethra recur sooner or later, and if the urethra be carefully explored they will be found to have re-contracted to a greater or less extent, within a comparatively short time after the cessation of treatment. (3) That strictures of the penile urethra rarely disappear completely under dilatation, and always recur, unless operated upon by urethrotomy; they rarely, however, recur—in the absence of fresh gonorrhœal infection—when operated upon according to the Otis method, if the operation be properly performed.

It is usually possible to prevent re-contraction of a simple stricture if we can obtain the co-operation of the patient. Strict adherence to the principles of genito-urinary hygiene, and occasional dilatation of the urethra by means of a moderately large steel sound will generally prevent re-contraction, at least to a degree

appreciable to the patient. When the patient is able to secure the services of a surgeon, it is unnecessary for him to be instructed in the art of self-instrumentation; under other circumstances however, he should be taught the use of the sound and instructed to introduce the instrument at first once a week, later on once in two weeks, and finally once a month. When once an individual has suffered from organic stricture the introduction of the sound becomes an important item in his *toilette*. An English surgeon once remarked that the sound was one of the most important articles of the baggage of a traveling English gentleman. Judging by the frequency of stricture among our American population, the English nobility have no monopoly in this respect.

*The prognosis of stricture as regards its danger to life,* varies greatly according to the duration of the disease, the severity of its complicating conditions and sequelæ, and the character of the operations which are undertaken for its cure. *Probably the most important factor in determining the prognosis is the condition of the kidneys:* The renal structure and function are almost invariably impaired—in fact, in organic stricture of long standing such impairment is to be inferred. Pathological aberrations of the kidney are not only immediately dangerous to life—either through acute exacerbations of inflammation induced by intemperance or exposure, or by reflex inhibition of the function of the kidney produced by surgical shock in attempts at the cure of the stricture—but they bear an important relation to the future welfare of the patient, after the primary condition has been relieved. It is probable that a patient who has once suffered from secondary disturbances of the kidney, incidental to organic stricture, is rarely, if ever, a sound man again. His kidneys—and for that matter, the structures composing his entire genito-urinary tract—are in a weakened, possibly degenerated, relaxed and irritable condition which predisposes to conges-

tion and inflammation. The slightest excess or exposure in such individuals is apt to bring on acute Bright's disease of the ordinary form. Chronic nephritis is liable to supervene at any time. Pyelitis may develop after the patient is apparently cured of his stricture. In brief, it may be said that a patient who has once suffered from severe organic stricture possesses ever afterward a *locus minoris resistentiae* in the direction of the kidneys, which is apt at any time to lead to pronounced renal disease, with perhaps a fatal result.

Stricture may result fatally by the supervention of uræmia, consequent upon complete inhibition of the already impaired function of the kidneys. Retention of urine, due to inflammation of the stricture, may lead to a fatal result through rupture of the urethra or bladder with consequent extravasation of urine, or by occurrence of acute cystitis,—perhaps with gangrene of the vesical mucosa. In these conditions, secondary to retention, the patient may sink into a typhoid state and die, the condition being modified by a greater or less degree of uræmic intoxication. Septæmia in its various forms may result. Debility and nervous exhaustion from pain and loss of sleep in combination with the depressing effects of urinary intoxication or fever, are important elements in the production of a fatal result in all cases.

Stricture, *per se*, is not capable of producing a fatal result, but it may and often does produce the conditions which have been mentioned, which, in addition to the effects of various complicating pathological states are sufficient to destroy life.

Notwithstanding what has been said regarding the serious character of marked cases, it is surprising how rapidly some apparently desperate cases of stricture will improve, when once the obstruction has been removed. Even when the kidneys are seriously impaired, the constitutional symptoms marked and the secondary

bladder changes severe, the patient may improve with wonderful rapidity, as soon as the patency of the urethra has been restored. The improvement in the patient's general condition is often times remarkable. The very gradual involvement of the upper portion of the genito-urinary tract in the secondary pathological conditions in stricture, probably explains the tolerance of the patient for quite severe renal and bladder changes—it may also explain to a certain extent the promptness of the improvement after cure of the stricture.

A condition not usually recognized in stricture is the greater or less marked toxæmia due to the constant absorption of ptomaines and toxalbumen from behind the point of obstruction. This toxæmia has much to do with numerous little ailments of which the patient may complain, but which he rarely attributes to his stricture until the cure of the latter suggests the cause of numerous other disturbances, by the fact of their sudden and complete disappearance. This toxæmia too, constitutes a constant predisposition to urethral chill. The nervous system is loaded, so to speak, and ready for an explosion which instrumentation is often times all sufficient to bring about.



# CHAPTER VIII.

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## THE TREATMENT OF STRICTURE.

### GENERAL MANAGEMENT AND SELECTION OF METHOD.

The successful treatment of stricture of the urethra is dependent not only upon the proper selection of surgical methods of management and skill in their performance, but to a greater degree upon the manner in which the general management of the case is conducted. Careful attention on the one hand, or neglect on the other, may determine the success or non-success of surgical treatment. Thus dilatation may fail of its object, because of irritability or resiliency of a stricture, which attention to certain details in the general management of the case might avoid. Urethrotomy, divulsion, or perineal section may result fatally, because of failure on the part of the surgeon to carefully study the condition of other portions of the genito-urinary tract and of an inappreciation of the general and local conditions prevailing at the time of the operation.

In no disease of the genito-urinary tract is attention to genito-urinary and sexual hygiene more essential than in the management of stricture of the urethra. Regulation of the diet, temperate habits, sexual moderation or abstinence, and avoidance of exposure to cold and wet, are all important. The use of tobacco should be interdicted as tending to induce general irritability and hyperæsthesia. I believe, moreover, that it is

especially irritating to the genito-urinary tract. Chilling of the feet and legs is apt to be especially injurious, its effect upon stricture, in the production of acute hyperæmia and inflammation, being precisely similar to its results in enlargement of the prostate, in which disease the disastrous effects of exposure are so well known. The administration of alkalies for the purpose of neutralizing the urine is essential in the majority of cases. When pronounced cystitis exists, certain remedies will be found beneficial by preventing decomposition of the urine and consequently lessening its irritating properties. Boracic acid in ten or fifteen grain doses several times daily, napthalin, creosote in small doses, oil of eucalyptus, benzoate and salicylate of soda and in some instances small doses of turpentine, are useful for this purpose. In my experience the oil of eucalyptus in 10 minimum doses has been of especial value. The activity of the skin should be promoted by Turkish baths and rubbings. The effects of sudden atmospheric changes should be avoided by wearing warm flannel garments of uniform weight. Exercise should be taken in moderation; fatigue and over-exertion should be avoided—perfect rest may possibly be indicated.

Certain local measures are very essential in the management of stricture. A tendency to spasm and congestion at the site of the stricture may be prevented by the daily use of hot sitz-baths or the occasional application of leeches to the perineum. As a matter of routine, I advise my patients to take a hot sitz-bath nightly before going to bed. By proceeding in this manner, it will be found that the majority of cases of stricture will be much more tractable than under ordinary circumstances. In some cases of very tough, resilient stricture, the canal may be dilated much more readily if the patient be directed to take an injection of water as hot as can be borne night and morning. These injections should be kept up for half an hour at a time,

and may advantageously be made antiseptic by the addition of bichloride of mercury 1 in 20,000, or boric acid in saturation.

Where manipulations of the canal tend to excite urethritis, hot bichloride irrigations, as recommended for chronic urethritis, may be cautiously employed. The various balsamic preparations are of service in such instances.

Pain and spasm may be excited by each attempt at dilatation, in spite of the general measures already recommended. Under such circumstances, a small dose of morphia may be given hypodermically, by suppository, or by the mouth, a short time before the operation. When each operation tends to produce urethral chill or fever, the administration of opium has a decidedly conservative and prophylactic effect. I have found that in these cases of irritable stricture with a predisposition to urethral fever, thorough irrigation of the canal with a hot bichloride solution before and after the introduction of a sound or before cutting operations, as the case may be, will generally obviate the difficulty. I desire particularly to call attention to the advantages of this procedure, as it will certainly tend to prevent the septic element in the production of urethral fever. Quinia, jaborandi, eucalyptus and diuretin are probably all serviceable as prophylactics against chill, but I have found the eucalyptus particularly valuable.

#### SELECTION OF METHOD.

*The various forms of treatment which have been recommended for stricture are as follows:*

1. Caustics.
2. Continuous dilatation.
3. Gradual dilatation.
4. Dilating urethrotomy, or a combination of section and rupture.

5. Divulsion or rupture.
6. Internal urethrotomy.
7. External perineal section or urethrotomy with a guide.
8. External perineal section without a guide.
9. Electrolysis.
10. Subcutaneous section.
11. Excision, with or without a plastic operation.

#### CAUSTICS.

The treatment of stricture by caustics is a relic of surgical barbarism, and is hardly worthy of serious attention. The objects for which it was originally recommended were (1) the destruction of the stricture, and (2) diminution of the sensibility of the mucous membrane for the purpose of allaying irritability and spasm of the canal. The substance used was generally caustic potash. Whatever the results may have been, as far as restoring temporarily the calibre of the canal was concerned, the inevitable consequence of such atrocious surgery must necessarily have been the substitution of a chemical stricture for an ordinary organic one. As is well known, stricture due to actual destruction of tissue is the most severe form with which we are called upon to deal. All the other methods of treatment which have been enumerated have their advocates at the present day—either as a matter of routine or a range of treatment from which to make a selection—and may under proper circumstances be practised with advantage in different cases. The selection of the method is necessarily—within certain limits—a matter of choice on the part of the individual surgeon. The various legitimate methods will receive special consideration after their applicability to the various forms of stricture has been outlined.

For practical purposes the surgical treatment of stricture may be divided into that of,

- As regards location.
- 1. Stricture of the meatus.
  - 2. Stricture of the penile urethra.
  - 3. Stricture of the deep urethra.

- As regards character.
- a. Simple uncomplicated stricture.
  - b. Irritable stricture.
  - c. Resilient and elastic stricture.
  - d. Recurrent stricture.
  - e. Dense and hard tortuous stricture.
  - f. Complicated stricture.
  - g. Traumatic stricture.

To a certain extent the treatment of each particular case is modified by the calibre of the contraction; for example, in tight strictures which it seems advisable to treat by dilatation, metallic instruments should not be used until a moderate amount of dilatation has been attained. The treatment is further modified by the occurrence of complications, such as false passages, retention of urine, severe cystitis and pericystitis, infiltration of urine and abscess, fistulæ, enlarged prostate, etc.

#### STRICTURE OF THE MEATUS.

Irrespective of their causation, strictures at the external orifice of the urethra require free division by the knife. Attempts at dilatation are absolutely useless and simply serve to produce irritation. The peculiar structure of the meatus is such that it cannot be permanently stretched, and attempts to do so not only produce local disturbance, but also reflex irritation and spasm of the deep urethra. The proper method of performance of meatotomy, has been outlined as an essential preliminary to the proper exploration of the urethra. Any meatus which prevents the introduction of an instrument of sufficient size to distend the remainder of the canal to its extremest

capacity, must be considered as in a strictured condition. As already remarked, stricture of the meatus may be a relative affair—this is particularly true of the congenital form, which assumes surgical importance only in case of the occurrence of organic or functional diseases of the urethra behind it. In all cases of obscure nervous affection, with concomitant symptoms referable to the sexual organs, it is wise to perform meatotomy, for whether or not there exists apparent irritation at the meatus, the effect produced upon the nervous system is frequently strikingly beneficial; that this effect may sometimes be a moral one is admitted.

In many instances of narrow meatus, the urethra behind it may be demonstrated to be in a pouched condition, by exploration with a bent probe. In this pouch, inflammation goes on indefinitely, its perpetuation being facilitated by the accumulation and decomposition of a few drops of residual urine. Meatotomy, therefore, often cures a most obstinate gleet.

#### STRICTURE OF THE PENILE URETHRA.

Strictures in the pendulous portion of the urethra give rise to greater annoyance to the patient, and more perplexity to the surgeon on the average, than those of the perineal portion of the canal. They are, however, obviously less dangerous, and their direct and remote results are less serious, than those occurring deeper down. They comparatively rarely contract so markedly as to produce serious obstruction to the flow of urine, and where they form slowly, we often meet with cases in which several comparatively tight strictures exist, but have produced little or no trouble, having been either discovered accidentally or during an exploration for the purpose of determining the cause of an inter-current simple urethritis. I have recently operated upon a young man who had three strictures of the pendulous urethra, the tightest of which would barely admit the closed

blades of the dilating urethrotome. These strictures had produced no inconvenience whatever, and probably would have remained undiscovered for some little time, if the patient had not, at the suggestion of a friend, submitted himself to an examination, for the purpose of ascertaining whether by any possibility a gonorrhœa which he had contracted some years ago, had left any permanent results. Such a passive condition of strictures in this situation is of course, not to be expected, for as a rule, they give rise to considerable annoyance, to frequent attacks of so-called "bastard clap," or to an indefinite perpetuation of gleety discharge.

Although strictures in any portion of the canal are apt to give rise to more or less marked vesical irritation, the liability to this annoying symptom seems to be in direct ratio to the distance from the meatus. Comparatively slight strictures in the deep urethra will produce by direct irritation through contiguity of structure and nervous supply, annoying frequency of micturition. In occasional cases however, this symptom is the principal feature of a stricture at or near the meatus.

*The degree of contraction in penile strictures* is very variable. It is rather exceptional than otherwise, that such strictures are contracted to so marked a degree as is frequently noted in the deep urethra. This statement may seem to be at variance with the experience of many surgeons, but the discrepancy is explicable by the fact that the majority of surgeons do not recognize that vast number of cases in which stricture of large calibre exists. When I speak of the relative rarity of stricture of small calibre in the penile portion of the urethra, I mean as compared with the total number of those which may be observed by careful exploration with the bulbous bougie.

Stricture of the pendulous urethra is very apt to be multiple. Indeed, there are few cases in which a full sized bougie or the urethrameter fails to detect two or

more points of contraction in different parts of the canal. These strictures are frequently irritable, and almost always resilient. They are a potent cause of chronic urethritis and gleet, and explain the obstinacy of very many apparently incurable cases of urethral discharge. Even when they are not, strictly speaking, the cause of the chronic inflammation, they invariably tend to perpetuate it. If the profession had nothing else for which to thank Dr. Otis, it would still be under lasting obligations to him, for his demonstration of the true pathological condition in the majority of those obstinate cases of gleet, which have so long been the *bete noir* of the surgeon. *When such strictures are irritable, as they are very apt to be, a very slight exciting cause is sufficient to excite urethritis*, the severity of which depends upon the degree of irritation. In short, penile strictures of large calibre may be said to constitute a constant predisposition to both virulent and simple urethritis.

Dr. Otis' remarks upon the subject of gleet and its relations to urethral stricture are of the greatest practical value and well worthy of reproduction.

"The secretion of the urethral mucous membrane serves as a protector and lubricant for the preservation of this membrane from the contact of the irritating urinary fluid. It is made up of germinal granules—particles of bioplasm (Beale) which rise up through the interstices of the sub-mucous cellular tissue, are transuded through the basement mucous membrane and become organized as the protective and lubricative epithelial cells of the urethral mucous membrane, and where the conditions of its evolution are in every respect perfect, in quantity just sufficient for the lubrication and protection of this structure. This is never sufficient to be perceptible to the naked eye, except as a moist glazing of the surface. Any excess is always the result of an abnormal stimulation of the natural processes, except in a single instance, purely physiological,

when it proceeds from an erotic excitement and appears at the meatus as a transparent mucous exudation which passes off with the cessation of the nervous impression which provoked it. The causes which unduly increase the secretion of this membrane (and in speaking of the mucous membrane I include the glands, crypts, and follicles made up of its local reduplications) are to be divided into two classes: first, active inflammation set up by contagion or clap, and second, mechanical injury or some obstruction, as urethritis from lodgement of a calculus, injuries caused by instrumental violence or irritant injections, or urethral obstruction from chronic inflammation.

The first effect of an approaching inflammation of a mucous membrane is an increase in the natural secretion. The mucous cells are hurried along through their different stages of development, and as the amount of secretion increases, it is less and less perfectly elaborated; the germinal material is drawn to the surface with increasing rapidity, until cells, which in health pass through a gradual development from the germinal granule to the fully formed epithelial scale, now appear as a mass of emasculated corpuscles, pus cells, which constitutes what we are accustomed to term, a purulent discharge.

*The inflammation is thus characterized during its continuance, whether arising from mechanical or chemical causes. The character of inflammation in the urethral mucous membrane varies in degree rather than kind.\* The duration of the inflammation varies, as the cause is more or less vicious in its onset, or more or less persistent in its influence.*

The active stage of an inflammation of the urethral mucous membrane has a duration in the majority of cases of four or five weeks. In the cases where complete recovery does not take place within this time, there

\* Italics mine.

is usually a subsidence of the more acute symptoms and the case is then characterized by a painless or nearly painless discharge, more or less profuse and more or less purulent, which persists in spite of judicious treatment for weeks, perhaps months, often years; at times reduced to a mere secretion which sticks the lips of the meatus together, when upon a slight indiscretion in diet, or a little sexual or vinous indulgence, within a few hours it may return as a free and possibly painful purulent discharge. This form of urethritis, which has for time immemorial afflicted humanity, and which has probably been the source of more trouble to patients and surgeons than any other known difficulty, is familiarly known as *gleet*.

This is usually considered as a sort of chronic gonorrhœa and treated on the same general principles, (by internal remedies and local injections) or is looked upon as the result of a debilitation of the urethral mucous membrane but having no specific or contagious property associated with it, and is treated by specific and local means. Now, if it can be established that *gleet* is the result of a mechanical condition, that it may be produced without the previous occurrence of a gonorrhœa, by the simple obstruction of the free discharge of urine through the urethra, and which obstruction may occur as a result of any inflammation or injury which implicates the sub-mucous urethral tissues, it will then be clear that no treatment which is not based upon the detection and removal of the mechanical difficulty can be more than palliative. And if it can be shown that the detection of contraction is possible *in all cases of gleet*, and that its removal is *certain* to cure the *gleet*, the proof of the non-specific character of *gleet* may be considered to be established.

While I am certain that a variety of remedies, local and general, may, when judiciously employed, enable the patient to pass through gonorrhœa with much more

comfort and less danger of subsequent trouble than without treatment, yet I am prepared to state as my opinion based upon a large personal experience, *that it is a self limited disease in its acute form*, and when it lasts longer than four weeks, or when apparent recovery takes place and the discharge breaks out afresh without new exposure, *that there is a complication present*, either as a result of the current inflammatory trouble, or of some inflammation antecedent to the attack, which causes the continuance of the trouble, and which must be appreciated and removed before any permanent cure can be had. This complication is *urethral stricture*—stricture in the sense of an abnormal contraction of the urethral calibre at some point at or between the meatus urinaris and the bulbo-membranous junction; and I will further state it as my conviction, that the continuance of the inflammatory trouble (and wherever there is a urethral discharge, there is incontestibly more or less inflammatory trouble) is due to the irritation kept up by the arrest, more or less complete, of the stream of urine at the point of stricture and by the imperfect emptying of the urethra after urination.

Chronic gonorrhœa—gleet—is dependent as a rule on abnormal contraction of the urethral canal.

*Chronic urethral discharge means stricture.* I am quite aware that well defined stricture may be present without a palpable discharge, but there is always to be found evidence of a certain degree of irritation present in all such cases, although there may be no appreciable discharge. When, however, there is discharge, there will in every case be found, if the examination be efficiently made, a well defined and unmistakable point of stricture."

After stating that the ordinary sound is practically valueless for diagnostic purposes, Dr. Otis says that proper exploration means the use of the bulbous bougie or the urethrameter. This is not too arbitrary a position

by any means, and must meet with the unqualified endorsement of every surgeon who has command of the subject.

There are some points in Dr. Otis' arguments that cannot be accepted unhesitatingly. He asserts that gonorrhœa has a self limited course when uncomplicated, this course comprising a period of about four weeks, and that cases running over this time are complicated, usually by recently formed or antecedent stricture. This view implies a specificity and a limitation of course of gonorrhœa that few will be willing to admit. Complications or no complications, there is the greatest variation in the course and duration of gonorrhœa, even when several observed cases are due to the same source of infection. In order to determine the exact normal course of the disease, a series of patients would be required who could be confined to bed and placed under precisely the same conditions as regards diet, sexual excitation, rest, etc. This would confessedly be difficult of accomplishment. Were this scheme practicable, there would even then, in my opinion, be found a wide variation in the duration of the cases. I cannot believe that so arbitrary a statement as that of Dr. Otis, to the effect that a case of over four weeks duration means complications—and usually stricture,—is warranted by the facts.

Admitting that there are complications of one kind or another in cases of over four weeks duration, it is hardly fair to assume that stricture is nearly always responsible for the prolongation of the case, *unless the contractions found are admitted to be points of normal contraction, which have become abnormal, by virtue of the pathological state of the mucous membrane, and which are capable of prolonging the latter.* Looked at from this standpoint, stricture is certainly, in by far the majority of cases, the cause of perpetuation of a gonorrhœal discharge. Clinically, such points should be looked upon

in the same light as true adventitious stricture deposit, *after a reasonable time has elapsed during which thorough medication, both general and local, has been carried on.* It certainly would not be wise to condemn a urethra to operation, even though definite contractions have been detected, until several months careful treatment have proved inefficacious, especially in first attacks of gonorrhœa.

Dr. Otis fails to recognize as important, the element of posterior urethritis in the perpetuation of gleet. There is hardly any question that inflammation of the deep urethra is often responsible for frequently recurring re-infections of the anterior canal. As a matter of common experience it is found that posterior urethritis is quite frequently responsible for a gleet with acute exacerbations, which lasts for months, or perhaps indefinitely, after the supposed cause—urethral stricture—has been removed. It is true that a persistent gleet after urethrotomy often means an imperfect operation, but that this inference is not always just, is shown by the experience of many keen observers.

Another point which must be considered, is that we meet with many, many instances where men have had gonorrhœas galore in their youth, the discharge often times having been of very long duration, yet they have never had symptoms of stricture. It is possible—nay, probable—that the urethrameter will show in all these cases, contractions of the canal, but the individual goes through life without ever realizing that he has any morbid condition of his urethra. It is well not to be hasty regarding operative procedures in gleet following first attacks of gonorrhœa. One may well be cautious here, whilst he would be foolish to temporize with a case in which frequent attacks have occurred. He would be presumptuous indeed, who would attempt to bumptiously combat Dr. Otis' teachings. He has undoubtedly done more for urethral surgery than any

surgeon of this day and generation, but as is true of all teachers of a new theory, there is danger that his precepts may lead to too arbitrary conclusions. That I appreciate fully the doctrines of Dr. Otis regarding the relation of gleet to urinary obstruction, is shown in my remarks upon the relation of points of normal relative indistensibility to pathological states of the mucous membrane of the urethra.

The more important of the conditions which, in addition to stricture, must be taken into account in estimating the causes of gleet are as follows:

1. Constitutional debility.
2. Intemperance, both alcoholic and sexual.
3. The gouty and rheumatic diatheses.
4. Tuberculosis of the genito-urinary tract.
5. Chronic superficial urethritis, with or without distinct erosions.
6. Peri-urethritis or loss of elasticity—nascent stricture.
7. Folliculitis and chronic inflammation of lacunæ.
8. Cowperitis.
9. Posterior urethritis, i. e. prostatitis folliculosa.
10. Chronic abscesses from peri-urethral phlegmon.
11. Urinary fistulæ.
12. Neoplasmata.

Admitting stricture to be the most frequent cause of gleet, the above conditions are still worthy of the most discriminating attention.

There is one point which should be constantly borne in mind, and that is, as already intimated, that the fact that the urethra will permit the introduction of a large sized steel sound, is no evidence that stricture is not present, for it will often be found upon exploration with the bulbous bougie in such cases, that one or more strictures of large calibre exist. I am constantly operating upon cases of this kind. In a recent case the urethra was

dilated sufficiently to admit an 18 English sound, yet upon the slightest sexual excitement or indulgence in liquor a free discharge occurred. On exploration with the bulbous bougie I found a resilient stricture of large calibre at a depth of  $3\frac{1}{2}$  inches from the meatus. The presence of this stricture explained the stubbornness of the case, and I therefore suggested and performed internal dilating urethrotomy with a successful result.

The pronounced tendency to irritability and resiliency on the part of strictures of the pendulous portion of the urethra constitutes the principal obstacle to successful treatment by dilatation. I have found that dilatation in cases of stricture in this portion of the canal is usually disappointing, and that the patient either does not get entirely well of his gleet, or he apparently does so only to experience a recurrence of urethritis upon the supervention of the slightest exciting cause. I venture the opinion that very few cases of stricture of this kind are ever thoroughly cured, excepting by cutting, and experience has impressed upon me the necessity of radical interference and the uselessness of temporizing by dilatation. I therefore would advise urethrotomy in all marked cases, and in the slighter forms where the contractions do not readily yield. When stricture is young and soft—i. e., of recent date, and not yet fully organized—dilatation offers a good prospect of a cure, and it is but just that the patient be given the benefit of the doubt and an attempt be made to cure the condition without the radical operation. In old cases, no matter if they be apparently slight, dilatation is not apt to be successful.

*The prospect of cure of penile strictures by dilatation is directly proportionate to their distance from the meatus.* Strictures located anywhere between the meatus and a depth of  $2\frac{1}{2}$  inches, bear almost the same relation to dilatation, as far as the prospect of a cure is concerned, as do strictures directly at the meatus.

When a stricture of the penile urethra is of small or moderate calibre, that is, below 15 or 16 French, it is often advisable to begin the treatment by dilatation with soft instruments, just as would be done in stricture of the fixed urethra. If desired, the dilatation may be carried up to a point where the resiliency of the stricture begins to manifest itself; urethrotomy then becomes necessary. Some cases will apparently dilate readily at each sitting; but little progress can be made, as re-contraction seems to occur during the intervals between the operations of dilatation. The canal may be dilated apparently to its fullest capacity, so that it will admit a large sized sound, and the patient may be discharged, yet in a short time he will return to his surgeon complaining of a recurrence of urethritis. In such cases exploration with the bulbous instrument from time to time will show whether the stricture is really absorbing or not. When improvement is not steady and permanent, resiliency of the stricture may be suspected, no matter how large a sound the urethra may admit. The only way to proceed in such cases is to perform a cutting operation. The resiliency and elasticity just described are rarely met with in strictures of the deep urethra. They are, however, the rule in those occurring in the penile portion of the canal. The fact that dilatation is so unsuccessful when applied to strictures of the penile portion, as compared with those of the deep urethra, is probably explicable by anatomical differences in the location of the stricture. In some cases of stricture of the penile portion of the canal, the thickening and induration occur principally in the structure of the mucous membrane proper and just beneath it, rather than in the erectile tissue, and moreover, the process occurs at a point of normal inelasticity of the canal, i. e., at a point which nothing will dilate effectually. The infiltration which occurs in deep strictures is more extensive, and is located principally in the corpus spongiosum, beneath

the mucous membrane at a point where the urethral walls are thick. It is located, moreover, upon each side of the bulbo-membranous junction and chiefly anterior to it, rather than at a point which exactly corresponds to it. The pressure of the sound produces absorption at this point on account of the thickness and succulence of the tissues and the abundance of the absorbents. Stricture of the mucous membrane of the deep urethra is not so apt to be produced by strong injections as it is in the penile portion. Virulent inflammation is not so severe in the deep urethra, as a rule, as it is in the anterior portion of the canal.

When the urethral mucous membrane is severely abraded, the consequent stricture is invariably tougher and more inelastic than under ordinary circumstances. Stricture of the penile urethra is very much like traumatic stricture in this respect; it will be found to be precisely like the latter—or nearly so—in respect to its amenability to treatment by dilatation.

Another point which is not generally recognized, is the relative unrest of a stricture in the penile urethra, incidental to varying conditions of blood supply and erection.

*The treatment of stricture of the penile urethra may may be briefly summed up as follows:*

1. Those located within  $2\frac{1}{2}$  inches from the meatus cannot possibly be cured by dilatation, and must be cut.
2. Pronounced cases in any portion of the penile urethra must be cut, either immediately or after preliminary dilatation, in by far the majority of cases.
3. The treatment of marked cases, i. e., those of small calibre, may be begun by continuous or gradual dilatation with soft instruments up to the size of 15 or 16 French, or even larger, and in some cases it may be advisable to continue the dilatation with steel instru-

ments beyond this point, until the stricture shows irritability.

4. Strictures of large calibre, strictures of recent formation, and those consisting of points of normal inelasticity which are perpetuating gleet, may be treated by dilatation, the patient being forewarned that the treatment is apt to prove unsuccessful, and that urethrotomy will probably be required either within a short time, or later on, on account of a recurrence of urethritis dependent upon the contraction. In other words, the patient should be informed that the treatment by dilatation, although it may prove efficacious in temporarily relieving the gleet and other symptoms of stricture, may, at the same time fail to produce a satisfactory result, and that he will constantly be predisposed to attacks of inflammation from the slightest indiscretion. Should the patient be satisfied with treatment of this kind, it is hardly wise for the surgeon to insist upon an operation.

*By the term internal urethrotomy in connection with strictures of the pendulous urethra, I mean the combined operation of dilating urethrotomy according to the Otis method.*

#### STRICTURE OF THE DEEP URETHRA.

*Stricture of the deep urethra*, implies those contractions which involve that portion of the urethra embraced within the limits of what has been termed by Thompson, *the bulbo-membranous region*. Strictures in this location are much more important with reference to the frequency of occurrence of those serious secondary and complicating conditions which are intrinsically dangerous to life, than are those which are met with in the anterior portion of the canal. *It may be accepted as an invariable rule, that the gravity of stricture is directly proportionate to its distance from the meatus.* The structures surrounding strictures of the deep urethra are thick and vascular, and operations for their cure are a much

more serious matter than in other portions of the canal. The various complicating conditions which are apt to arise in the course of stricture of the urethra, are not only most likely to arise in these cases, but they involve such important structures that the most disastrous results are occasionally produced by them. The selection of the method of treatment becomes therefore a question of vital importance, and in a general way it may be said, that the more cautious and conservative the surgeon, and the more delicate his manipulations, the more likely he is to obtain a successful result. A most careful study of the case is necessary to determine the probable existence of serious vesical, and more particularly of renal complications, prior to beginning surgical interference. The duration, condition and calibre of the stricture, and the habits and general condition of the patient must receive most careful attention, as they will serve as excellent criteria for the selection of the method of treatment and for the guidance of the surgeon in the conduct of the case.

In strictures of small calibre which have existed for a considerable time, particularly in patients of intemperate habits and cachectic constitution, serious disturbance of the structure and function of the kidneys is to be inferred, independently of the revelations of urinalysis. Even in cases of stricture of comparatively large calibre in this situation, the greatest care should be exercised if the patient be at all broken down in health, is intemperate, or if the stricture is of long standing. Although in the majority of cases the danger of secondary and complicating conditions is directly proportionate to the degree of contraction, it must be remembered that the fibrous deposit at the site of the stricture, forms and contracts much more readily in some patients than in others, so that in some cases a stricture of comparatively short duration may be of very small calibre, while in others which have lasted for a much

longer time there may be comparatively little contraction. Other things being equal, however, *the tighter the stricture, the greater the danger of renal complications*, yet in cases of slow forming stricture of large calibre, the bladder and kidneys may be in a much more serious condition than in other cases of small calibre, in which the contraction has occurred quite rapidly.

In selecting the method of treatment, the surgeon should be influenced by the fact, that *no method of management of these deeper strictures, has yet been generally accepted as affording a prospect of a permanent cure*. Inasmuch, therefore, as radical operations do not promise a result sufficiently successful to counterbalance their dangers, we should, it seems to me, lean towards conservatism. If an approximately successful result can be obtained by simple and conservative measures, it is certainly unfair to subject the patient to the dangers of a radical procedure, particularly as the latter promises little if any more favorable results than conservatism. As far as my personal feelings are concerned I believe that the surgeon should for the nonce place himself in the patient's position and consider what method of treatment he would himself be willing to submit to, were he in a similar condition. He probably would not be inclined to submit to a dangerous operation, if there were any possibility of being relieved by simpler measures, even though it were necessary to continue the latter for the remainder of his days.

*Simple uncomplicated stricture of the deep urethra should be treated by dilatation.* If the stricture be of small calibre, it may be necessary to begin the treatment by the method of continuous dilatation with soft instruments, one instrument after another being introduced in increasing sizes, until the stricture is dilated as far as possible without the use of undue force. If a soft instrument is allowed to remain in the urethra for a few minutes, it will be found that the next larger size can,

as a rule, be quite easily introduced. In cases in which a small instrument is introduced with difficulty, it may be left in the canal for from six to twenty-four hours, at the end of which time sufficient absorption of the stricture will have occurred to permit of the introduction of a larger instrument and to permit of the passage of the urine beside the instrument while *in situ*. This is a desirable method for the treatment of some cases of tight stricture in which there is considerable congestion and a tendency to spasm, it being oftentimes rather hazardous to introduce and immediately remove an instrument for the purpose of exploration or dilatation, because of the danger of spasmodic or congestive retention coming on within a few hours thereafter, as a consequence of reaction. After the stricture has been dilated to a certain extent, this is not so likely to occur. Gradual dilatation performed in a conservative manner, with due regard to general and local measures for the correction of general nervous sensitiveness of the patient and irritability or congestion or the lesion, will usually bring about what is practically a cure, in by far the larger proportion of strictures of the deep urethra.

Anæsthetics are sometimes necessary for the purpose of facilitating dilatation. In very many persons, as a consequence of nervous excitement and fear, there will be excited by the passage of the instrument so much reflex spasm, that a comparatively small bougie will produce considerable bruising and inflammation at the site of the stricture. In such patients anæsthetics may be required; the preliminary administration of morphine is, however, often successful. It is certainly exceptional that radical operations become absolutely necessary, for, given a patient who is able and willing to visit the surgeon, or be visited by him, as frequently as may be required, and an operator who has an abundance of patience as well as expertness in urethral manipulations, gradual dilatation is generally perfectly success-

ful, or at least as satisfactory as any method of treatment has yet proven to be. The surgeon who regards the urethra as an insensate tube which is susceptible of the various operations of divulsion, cutting and forcible dilatation, without resentment, is the one who is able to report the largest number of cases of radical operations for stricture. In direct proportion to the degree of gentleness and patience which is exhibited in the management of strictures of the deep urethra, will be the satisfaction experienced in their treatment, although our lists of wonderful radical operations will be limited thereby.

With all the patience, perseverance and gentleness which can possibly be brought to bear however, cases occasionally occur which are not susceptible to treatment by simple dilatation. In some cases the tissue of the stricture is highly contractile and elastic, and resents dilatation beyond a moderate degree, all attempts at further stretching and absorption being followed by chill, exacerbation of urethritis or painful vesical symptoms. It may apparently dilate quite readily, and yet immediately recontract as soon as the dilatation is suspended for a time. In some patients, so much pain and irritation are produced by instrumentation that it is impossible to carry out the treatment by dilatation as it should properly be done. This condition of affairs rarely exists in simple stricture, but is frequently observed in those of the complicated variety.

The conditions requiring measures of a more radical character than simple dilatation are as follows:

1. *Irritable Stricture* : In this form of the disease the patient is usually of a highly nervous and irritable temperament and the urethra is extremely hyperæsthetic. Every attempt at dilatation is attended by severe pain and spasm—sometimes with general convulsive manifestations—and followed by chill, and perhaps more or less fever. Such strictures are also

resilient and present a marked tendency to congestion and inflammation, so that attempts at dilatation are not only unsuccessful, but it will be found that it will be impossible to pass instruments which perhaps were admitted with only a moderate amount of difficulty at a previous sitting. Strictures of this kind are usually of small calibre.

2. *Resilient and Elastic Stricture:* Although often irritable this form may be dilated quite readily without the occurrence of the symptoms just described, until the urethra is apparently dilated to its fullest capacity. The symptoms, however, are not completely relieved, and on exploration with the bulbous bougie it will be found that although a large sized sound has passed quite readily, the stricture is still present and is detected without difficulty. This condition of affairs is comparatively exceptional in the deep urethra, being more frequent in the penile portion, still it is occasionally met with deeper down.

3. *Recurrent Stricture:* This form is really a variety of resilient stricture in which the resiliency or elasticity does not immediately manifest itself. Such strictures re-contract within a very short time after the cessation of treatment, either spontaneously or as a consequence of the occurrence of some slight exciting cause. As a rule, resilient, elastic and recurrent strictures do not exhibit their evil propensities until they have been well dilated, when they become exceedingly stubborn. Very often they are of comparatively large calibre. Other things being equal, I am more inclined to apprehend such behavior on the part of a stricture of large calibre than one of smaller size. Like the preceding form, recurrent stricture is more frequently seen in the penile portion of the canal, although occasionally seen in the deeper urethra.

Recurrence of stricture is most rapid and most certain to occur in gouty or rheumatic subjects. The

habits of the patient have a very important bearing upon this form of stricture.

4. *Very hard stricture of cartilaginous consistency and long duration:* Strictures of this kind, although often traumatic, may arise from the ordinary cause, i. e. virulent urethritis. They are usually tortuous, and instruments can be passed only with great difficulty. Dilatation cannot be carried beyond a moderate degree owing to the density of the quasi-cicatricial tissue of which they are composed. Strictures of this kind will neither dilate—or at least if they do so at all they immediately recontract—nor can absorption be induced in them by pressure; a case of stricture in the deep urethra which involves half or three-quarters of an inch or more of the canal, is apt to present these characteristics.

5. *Hard and tortuous complicated stricture:* Strictures of this kind are most apt to be complicated by serious retention, urethral rupture and urinary infiltration or the formation of fistulæ. There may be considerable infiltration of plastic material, not only in the urethra, but in the cellular tissue of the perineum about it. There is invariably a formation of dense fibro-connective tissue about these parts if fistulæ have developed.

6. *Cases in which economy of time is necessary or the condition of the patient is such as to urgently demand relief:* Non-resident patients who cannot afford the necessary time and expense involved in the treatment by dilatation must be included under this head.

Irritable, resilient, and recurrent strictures of large calibre in the deep urethra are best treated by external section, although the combined method of urethrotomy and divulsion, a relatively small nick being made in the strictured tissue—just sufficient to facilitate rupture—sometimes gives good results. American surgeons, however, are fast giving up all cutting operations in the

deep urethra with the exception of external section. When strictures of this kind are of only moderately large calibre, the tissues being relatively dense and cartilaginous, perineal section is especially to be preferred, although simple divulsion is often a successful operation. The operation of divulsion is becoming deservedly unpopular in America, but I can see no reason for tabooing it altogether. A careful and discriminating selection of cases is of course necessary. For the general practitioner a divulsor is a dangerous article for his *armamentarium chirurgicum*.

It will be found in cases of irritable stricture that the more radical operations are productive of less constitutional disturbance upon the average than are repeated attempts at dilatation. *The contracted and resilient stricture tissue is so intensely hyperaesthetic, that the slightest attempt to stretch it may produce serious results; whereas division by incision or rupture, relieves the hyperæsthesia at once and produces comparatively little irritation, the danger from operation being rather of a direct character and incidental to the possible occurrence of sepsis, than to any remote impression produced through the medium of reflex nervous disturbance.*

The difference in the results obtained by stretching a contracted and highly sensitive fibrous structure, and completely dividing it, is well illustrated in certain cases of talipes, torticollis and other conditions in which fibrous, tendinous and muscular structures are shortened, and perhaps thickened, by interstitial connective tissue or fibrous deposit. Dr. Sayre, in his excellent work on Orthopædic Surgery, calls particular attention to this point; indeed, his criterion of the necessity for a cutting operation in these various deformities, is the spasm of the muscles and pain, produced by pressure or percussion upon the part when put upon the stretch. The same rule in a certain sense might be applied to stricture, for when we find that

attempts at dilatation produce severe pain and reflex spasm, with perhaps constitutional manifestations of an alarming character, further attempts at dilatation are contra-indicated, and more radical measures involving division of the affected tissue by rupture or incision are called for. Complete rest for a time, occasionally completely removes the element of irritability, with subsequent facility of cure by dilatation.

Very hard and cartilaginous deep strictures of long standing, whether complicated or not, require in my opinion, external perineal section. Especially is this true of cases complicated by serious bladder complications. The simpler varieties of complicated stricture do not necessarily call for such radical measures. In these pronounced forms of stricture, divulsion or internal urethrotomy are very dangerous as well as unreliable operations. There is great danger of hæmorrhage, the control of which is difficult on account of the depth of the operative lesion and the induration of the bleeding tissue, and also the special dangers of septic infection, infiltration of urine, abscess and fistulæ, due to the tearing by the operation, not only of the stricture but of the surrounding parts, these complications being favored by the heat of the tissues and the impossibility of maintaining a perfectly aseptic condition of the wound.

Internal incision of dense strictures of the deep urethra fails of its object because of the fact that it is impossible to introduce a cutting blade of sufficient size to thoroughly divide them. Indeed, in order to accomplish complete division the incision would in some cases necessarily cut almost entirely through the urethra. The relation of urethrotomy to deep strictures, is entirely different from that which it bears to strictures in the penile portion of the canal. In the latter the blade of the urethrotome, when properly used, nearly or quite divides the strictured tissue, which involves in many instances—and invariably in strictures

of large calibre—only the mucous membrane and a more or less superficial layer of the tissues beneath it. It is of course admitted that there are many cases of penile stricture that are extensively undurated, but these are exceptions to the rule. Dittel has shown some striking cases of this kind. In the dense varieties of stricture of the deeper portion of the canal, the blade of the instrument merely makes a comparatively superficial incision in the strictured tissue and does not completely divide it. It is obvious that complete rupture of strictures of this kind cannot be accomplished without considerable injury to the structure of the corpus spongiosum. Taking these things into consideration, external perineal section is to be recommended from the considerations that, (1) complete division of the strictured tissue is accomplished; (2) complete relief of retention, if such exists, is secured; (3) perfect drainage, and comparative facility of maintaining an aseptic condition of the wound are provided for; (4) haemorrhage can be easily gotten at and subdued; (5) it is an indubitable fact that the result obtained by the operation is better and much more easily maintained permanently by occasional dilatation of the urethra, than when internal operations are performed.

I have latterly adopted the view that there is less danger—even in the comparatively slight forms of stricture in the deeper portions of the urethra, in the performance of external perineal section than in either internal urethrotomy or divulsion.

Cases demanding immediate interference on account of the occurrence of retention, had best be treated by external perineal section. If, however, the patient can be under the control of the surgeon, and there is a prospect of a favorable result from more conservative measures, the case should be temporized with in the manner that will be shortly outlined, until such time as

it is practicable to begin treatment by dilatation. Non-resident patients with strictures of large calibre should be operated upon by the Otis method of dilating urethrotomy, or by divulsion. In certain selected and exceptional cases divulsion may be judicious. If the stricture be of small calibre external perineal section should be performed. In some cases of deep stricture, especially when complicated by retention, electrolysis i. e. galvanism is successful as a temporary measure, —as a preliminary to other treatment.

To sum up, the treatment of strictures of the deep urethra may be formulated as follows:

1. Simple stricture, small calibre.  
Large calibre.      Continuous dilatation, followed by gradual dilatation.  
Gradual dilatation.
2. Resilient, Elastic and Recurrent Stricture.      Internal dilating urethrotomy (exceptionally.)  
Divulsion (exceptionally)  
Perineal section (usually)
3. Hard, tortuous, old and complicated stricture.      External urethrotomy or perineal section.
4. Traumatic stricture.      Dilatation (very rarely.)  
Internal urethrotomy (rarely.)  
Divulsion (rarely.)  
Perineal section (usually)
5. Stricture complicated by retention.      Relieve the retention and temporize if possible. Begin dilatation as early as practicable.  
Perineal section if operation is urgently necessary.

5. Stricture complicated by retention.

Divulsion as the operation of necessity when no other means are at hand.  
Electrolysis i.e. galvanism as a temporary measure. This is to be followed by dilatation or urethrotomy as occasion requires.





# CHAPTER IX.

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## THE SYSTEMATIC TREATMENT OF STRICTURE BY DILATATION.

*Instruments for dilatation of stricture.* The instruments used for dilatation of stricture are of three varieties: (a) soft and flexible bougies, (b) fine, stiff, hair-like bougies known as filiforms, and (c) metallic sounds. The soft bougies are made in various patterns, the French and English varieties being those chiefly used. They are made in two forms, viz.: (a) with a plain conical point and (b) with an olivary tip. Their flexibility varies according to their composition. The best, or French bougies, are composed of a web of woven material covered with rubber. The plain conical form is the most serviceable. The olive pointed variety is designed chiefly to avoid passing the instrument into any of the crypts or enlarged follicles which so frequently exist in chronic urethral disease.

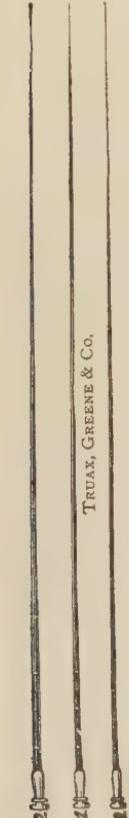
In selecting French bougies, it is best to choose those which are least flexible, as they are apt to be more durable and serviceable than the very flexible forms which are so limp that they bend upon themselves when they come in contact with the slightest obstruction. The French bougies are unquestionably preferable to the English, but unfortunately they are not very durable. The latter variety is less flexible but much more durable. Filiform bougies—so-called because of their thread-like fineness—are composed of rubber, catgut, or whalebone. The whalebone variety is the best. The rubber variety is of the same compo-

sition and construction as the ordinary French or English bougies.

Some forms of soft bougies are made with a small cap with a thread upon it, which may be fastened to a urethrotome or divulsor, the bougie acting as a guide or conductor for the larger instrument. Soft

bougies of considerable length may be procured when necessary to use them as guides for cutting or divulsing instruments. The whalebone variety is stiffer and more durable than those composed of rubber, and if dipped in hot water, the point may be moulded into any form which may be deemed useful for the purpose of avoiding any diverticula that may exist in the urethra and prevent the engagement of the bougie in the orifice of the stricture. When used as a guide, a tunneled instrument may be passed over them. The late Professor W. H. Van Buren was the inventor of the first tunneled instruments which were used and should have due credit for them. In commenting upon filiform guides, Dr. Keyes gives the following timely words of advice.\*

Fig. 52.  
Screw Tipped  
Guides.



1. The guide should be 18 inches long; any cracked, bent, fissured, or frayed out instrument should never be used. A short guide serves, but less well.

2. In employing a whalebone as a guide, it should first be introduced into the bladder, then threaded into the instrument to be guided, and the latter pushed

\*Op. Cit.



Fig. 53.  
Gouley's Whale-  
bone Guides.

gently down to the strictured point, while the whalebone is held stationary at the meatus. If force be used here, the slender guide may be doubled up and a false passage may be made. All this may be avoided by gently and continuously retracting the guide as the conducting instrument is passing the dangerous point and until it reaches the bladder. The length of the guide easily allows this to be done.

3. The loop of the instrument to be conducted, should always be amply large and smooth in front so as to have a rounded and not a cutting edge, and if the movement of extracting the guide as the tunneled instrument is being introduced cannot be performed as above described, both instruments should be withdrawn, for if the one be pushed forcibly, or the other pulled back, there is danger of cutting off a portion of the whalebone and leaving it in the canal, an accident which has occurred in very competent hands."

Dr. E. A. Banks, of New York, has devised some excellent whalebone bougies with filiform tips, as a substitute for the combination of a filiform bougie and tunneled sound. These are a most excellent device.



Fig. 54. Banks' Whalebone Bougies.

Sir William Brodie is partial to the use of bougies composed of catgut, on account of the readiness with which they may be bent to conform to the curve of the urethra. These bougies are not only old fashioned and bunglesome, but they are not durable.

Soft bougies and catheters are not so easily managed as stiff metallic instruments, as their flexibility

permits them to bend upon themselves when they come in contact with a tight stricture. It is difficult however, to produce injury with them, and inasmuch as instruments should be coaxed rather than forced through a stricture, their function in the treatment of strictures of small calibre is of great importance.

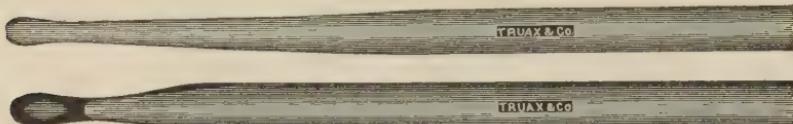


Fig. 55. French Olivary Bougies.

During warm weather gum instruments are apt to become soft and sticky; this may be prevented by dusting them with soap-stone. Care should be taken to have them perfectly free from oil before putting them away else they will become soft and worthless. They tend to grow brittle with age and it is not a difficult matter to break them. Care should consequently be taken to guard against the use of superannuated instruments. In cleansing soft instruments strong solutions of carbolic acid should be avoided, for if allowed to remain in such a solution for a few minutes, the polish is removed from their surfaces and they become rough, their facility of introduction being consequently impaired.

Soft instruments may be introduced with the patient in either the recumbent or standing posture, the latter being preferable. In practicing dilatation, soft instruments should be used whenever a smaller size than 16 French is required. In cases of comparatively tight stricture in which instrumentation produces considerable pain and spasm, the use of soft instruments is absolutely essential until the urethra has been dilated to a moderate size, after which steel instruments may perhaps be substituted.

Sounds are usually composed of inflexible metal, the steel instrument being the most popular. There

is an old fashioned variety composed of soft metal capable of being bent in any form, the use of which is very limited. There are three principal varieties of sounds: The French variety or Benique sound has a double curve, the field of usefulness of which is very narrow. It is sometimes of service however, in cases in which for any reason we desire to allow a steel instrument to remain in the bladder for a considerable length of time. The extra curve is designed for adaptation to the form of the pendulous urethra in the flaccid condition of the penis.

*The most important features of the steel sound are the shape and length of its point.* The English or Thompson instrument has a point the diameter of which is but slightly less than that of the remainder of the canal, it being comparatively blunt. The curve is rather long and the point is at right angles with the shaft. Van Buren devised a modification of the English instrument which is very popular among American surgeons. The point of this instrument is smaller, more conical, and the curve shorter than that of the English instrument. The Van

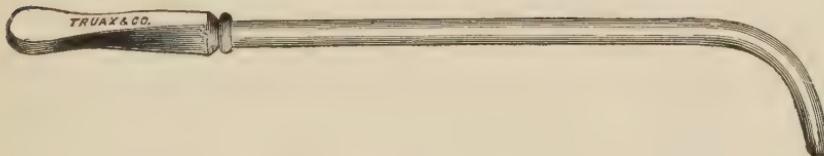


Fig. 56. Van Buren's Steel Sound.

Buren sound is advantageous on account of its short curve, the form being such as to make the instrument easily controlled by the hand. There is a compensatory disadvantage in the fact that the point is so small and conical, that injury at the hands of a careless operator, might be produced by it more readily than by the English instrument. As the sound acts somewhat on the principle of a wedge, it is obvious that stretching the stricture is more likely to be forced by the American than by the English instrument.

Care should be taken that the sounds are perfectly clean, i. e. aseptic, before their introduction into the canal. Should they become rough they should be thrown aside or polished anew.

It is desirable for the surgeon to have a second set of sounds with a very short curve and conical point, for use in the pendulous urethra. In the majority of cases of stricture it is not necessary to pass an instrument completely into the bladder, in order to secure the maximum of beneficial effects from the dilatation. Prostatic and vesical irritation, are very often caused by the mechanical injury produced by sounds introduced into the urethra, for the purpose of treatment of a stricture located several inches anterior to the neck of the bladder. There are several varieties of sounds with a very short curve, in the market. Messrs. Truax, Greene & Company have constructed a set for my use, the shaft of which is rather shorter than any which I have seen. It is advisable not to have the point of such an instrument too tapering, or it will be necessary to introduce it farther into the urethra than is necessary before its greatest diameter is brought to bear upon the stricture. The proper curve for metallic instruments, as already stated, is that known as the Thompson curve. This corresponds to the curve of a circle  $3\frac{1}{4}$  inches in diameter. The proper length of arc of such a circle for the beak of sounds is that subtended by a chord  $2\frac{3}{4}$  inches long. A shorter curve however is most useful as enabling the operator to keep the instrument under better control.

*Continuous dilatation* is of service in certain cases of tight stricture in which instrumentation is exceedingly difficult. In cases of this kind, considerable nicety of judgment is required regarding the advisability of withdrawing an instrument when once it has entered the bladder. The practice of continuous dilatation is certainly tempting under such circumstances, and the

surgeon is certainly excusable for hesitancy in deciding to remove an instrument which perhaps required the utmost patience and perseverance for its introduction, providing there exists, any possibility of benefit resulting if it were allowed to remain. It is usually perfectly safe to permit a small soft or filiform bougie to remain in the urethra after it has passed the stricture, and as a rule, the effect is beneficial, for in a short time it will be found that more or less absorption has occurred and the bougie which was previously tightly grasped has become loosened, after which it may be removed and an instrument of a larger size introduced.

The first instrument that is passed should be tied in the bladder and allowed to remain *in situ* for from 12 to 24 hours, during which time the urine may escape beside it; it certainly will do so at the end of that time. When the first instrument is removed, the next larger size should be immediately introduced, as a certain degree of re-contraction may occur in a few minutes and prevent the introduction of another instrument. A certain amount of urethritis is caused by the presence of the bougie, but this is rarely severe and will subside very soon after gradual dilatation has been substituted for the continuous method. Continuous dilatation should be practiced until a No. 10 or 12 French can be introduced, after which gradual dilatation should be instituted. Where it is practicable to do so, a very small catheter may be passed instead of a bougie, to facilitate evacuation of the bladder in case retention should occur. At the second passage of instruments as a rule, a small catheter or bougie may be introduced, even though at the first operation it may have been difficult to pass even a filiform bougie.

The principal objection to the use of the method of continuous dilatation, is the tendency to the development of inflammation of the bladder. This may be obviated by daily irrigations of the viscus with a mild,

warm antiseptic solution. Sloughing of the urethral mucous membrane with perineal abscess and fistula has been known to occur as a result of this method of treatment. Erichsen records a case of this kind. Such an accident could only occur as a result of too extreme distention, by forcibly introducing an instrument larger than is necessary. It is wise to practice this method in all cases complicated by retention, as soon as an instrument can be passed through the stricture.

*Gradual dilatation* is generally the most applicable method of treatment of stricture. It should be begun on about the third day after a preliminary exploration has determined the precise location of the stricture or strictures, and the various qualities of the lesion to which allusion has already been made. It may be necessary to vary the interval following the preliminary exploration according to the amount of reaction from the latter. Much depends upon the tolerance of the urethra for instrumental interference, and upon the nervous susceptibility of the patient. If a preliminary meatotomy has been performed, it is often well to wait until the meatus has completely healed before going on with the treatment of the deeper portions of the canal, unless the necessity for dilatation is urgent, as in very tight strictures in which retention may occur at any time. The irritation of the raw cut surface produced by the passage of the sound over it, invariably gives rise to a certain amount of reflex spasm of the deeper parts of the urethra. As a consequence of this spasm, much irritation and inflammation of the stricture may be produced by passing a comparatively small sized instrument.

If it be determined to treat the stricture by gradual dilatation, the treatment should be begun with the insertion of a small sound at the sitting next following the preliminary exploration, or as soon as the meatus has healed, as the case may be. The first instrument

passed should be small enough to be introduced without any difficulty. In this way the sensibility of the stricture may be to a certain extent blunted and the canal opened up, thus facilitating the passage of an instrument of sufficient size to distend the stricture. After the withdrawal of the small instrument, a second should be inserted which is large enough to distend the stricture, but which at the same time, does not require force for its introduction. If pain and spasm are excited the sound should be immediately withdrawn. If however, the urethra tolerates its presence, it should be allowed to remain for a minute or two to secure the full effects of the distention which it produces. It should now be removed and the next larger size introduced in the same manner. It is rarely advisable to use more than two, or at most three sounds, at a single operation, a single instrument being best if the stricture be very irritable. If the surgeon undertakes to hurry the matter he may produce severe urethritis, prostatitis, cystitis, epididymitis, or urethral fever, or may cause a perfectly tractable stricture to become irritable and resilient. Any of the accidents which have been mentioned may prove a serious complication, and in addition will inevitably delay the treatment. It is my opinion that the surgeon is quite often responsible for congestion and inflammation, irritability and resiliency of stricture occurring in the course of treatment by dilatation. One of the cardinal principles which should guide the operator is the avoidance of force, conjoined with efforts to coax the stricture, so to speak, to a cure. Nothing is gained by torturing the sensitive tissues of the lesion by the introduction of too large and too many instruments.

The preliminary administration of anodynes, the continuous use of nervous sedatives and antispasmodics, and if necessary anæsthetics, are frequently useful adjuncts to treatment by dilatation. The usefulness of

measures of this character is well illustrated by a case which is at present in my hands.

The patient is of a highly irritable nervous temperament, very sensitive, and dreads each operation of dilatation. I have been attempting for a long time to treat the case with metallic instruments, but until recently have been unable to introduce them without using more force than I consider advisable. The obstruction appeared to be due to severe spasm of the deep urethra. So severe was the spasm all along the canal that even the penile portion of the urethra contracted down so tightly about the instrument that some little force was necessary in its withdrawal. Within the last two or three weeks I have given the patient liberal doses of bromide of potassium and ergot, and have instructed him to take one-fourth of a grain of morphia one hour before visiting me. Much to my gratification, I have had no trouble in introducing steel instruments in increasing sizes, since the first occasion on which the morphia was taken.

The sudden acquirement of a spasmodic element in a stricture which is under treatment may indicate renal complication. In one of my own cases the formation of a peri-nephritic abscess, was heralded by severe spasm of a stricture then under treatment by dilatation.

At the next sitting, dilatation should be begun with an instrument a size smaller than the largest which was introduced at the previous operation. Should the urethra be very irritable it may be necessary to again pass as a preliminary measure a very small instrument for the purpose of blunting sensibility. Two sizes should be introduced as before.

The frequency of operations of dilatation should vary according to the exigencies of each particular case.

The majority of surgeons in their enthusiasm for a speedy cure of the stricture neglect to study the case

carefully, and consequently introduce instruments too frequently. It is not an unusual experience for me to meet with cases which have been tortured into irritability and resiliency, by the daily introduction of sounds at the hands of over-enthusiastic operators. *While it is permissible in very tight strictures, to introduce soft instruments every day, it is rarely beneficial and usually injurious to pass steel instruments oftener than once in three days. In the majority of cases once in four or five days or even longer is sufficiently often.*

Some patients will complain greatly of pain, and severe spasm with perhaps urethral chill and fever will result if the sound be introduced oftener than once a week. Quite prolonged intervals of rest are essential in some cases. I have met with cases in which I had formed the opinion that a radical operation was necessary, as a consequence of irritability and resiliency of the stricture, but when the patient has returned to me after an absence of several weeks I have been gratified to discover that the stricture could be dilated quite readily. The indications in such cases are very plain and should receive due consideration.

It is necessary in all cases of tight stricture to begin the treatment with soft instruments and perhaps by the method of continuous dilatation. After the stricture has been dilated to the calibre of from 10 to 12 French, steel instruments may be substituted. With steel instruments of small size there is great danger of producing injury. Such instruments do not pass of their own weight, but require a little force. The degree of pressure exerted requires some nicety of judgment, as it takes but little force to drive the point of a metallic instrument through the urethra, thus causing a false passage. In some instances it may be necessary to use soft instruments up to a considerable size before substituting sounds.

Dilatation acts in two ways: in the first instance,

the sound produces stretching of the stricture and temporarily increases its calibre. The next effect is the production of absorption of the adventitious tissue. In order for absorption to occur, it is necessary that a certain amount of reaction should follow the introduction of the sound. It is upon the increase of the nutrition of the part, incidental to the slight hyperæmia which results from the mechanical stretching of the stricture, that the cure of the lesion depends. This reaction must be kept within bounds, for when it approximates marked inflammation, the condition can only be aggravated by sounding. A slight increase in discharge following the use of the sound is usual; a marked increase is an indication that undue inflammation has been excited, and should serve as a caution against further attempts at dilatation until the parts have had time to recover.

For a short time after the introduction of the sound the flow of urine is facilitated on account of the mere mechanical stretching which the instrument has produced. This enlargement of the calibre of the stricture persists for from 24 to 36 hours, at the end of which time reaction occurs, with coincident hyperæmia of the diseased tissues and an increased activity of the processes of nutrition. A moderate amount of swelling results which serves to diminish the calibre of the stricture. Within a day or so however, absorption begins and continues for several days, at the end of which time re-contraction commences. If a sound be introduced during the time the reaction is at its height, actual inflammation is excited and the case is made much worse.

As the reaction produced by the sound diminishes, the benefits of the absorption are apparent in the increased size of the stream. If the operation has proved successful, the stream of urine will be larger than before the introduction of the instrument. The

rapidity with which reaction comes on, and its degree, and the amount and duration of the absorption vary greatly in different cases. A careful study of each particular case, teaches the surgeon when another opera-



Fig. 58.  
Otis' Endo-  
scopic Tube.

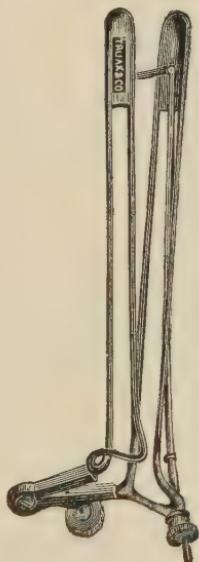


Fig. 58.  
Brown's Urethral  
Speculum,



Fig. 60.  
Klotz's Endoscope.



Fig. 61.  
Weir's Meatoscope

tion is desirable. If the canal be dilated in a routine manner and increasing degree every three or four days—more or less—many disappointments will be experienced. *Each case is a law unto itself and should be treated upon its own merits.* In some cases the urethra

will not tolerate any increase of the size of the instrument for several successive operations, it being necessary to introduce the same instrument several times.

The introduction of the sound usually occasions more or less smarting and a variable degree of pain, which is most marked as the point of the instrument approaches the neck of the bladder. As it passes over

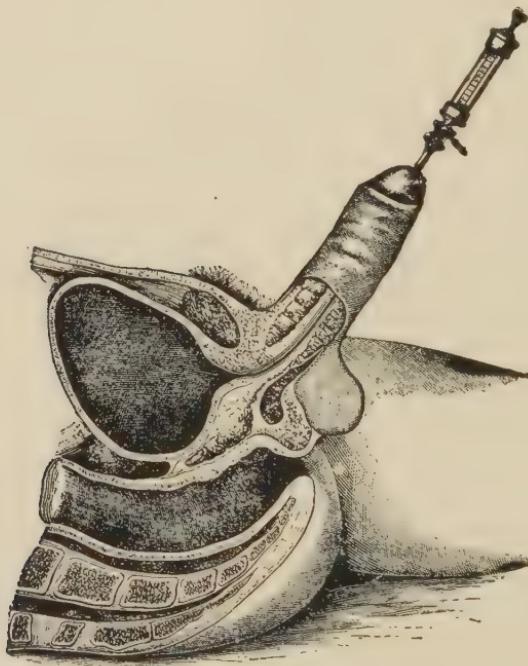


Fig. 57. Method of Injecting the Deep Urethra.—(*After Finger.*)

this highly sensitive portion of the canal more or less nausea and faintness may be produced; actual syncope not infrequently results. As already asserted, the patient should never be operated upon for the first few times in a standing posture, although it may be found to be more advantageous than the recumbent posture later on. A semi-recumbent position is perhaps most universally applicable. Care should be taken that the instrument is well



PLATE V.



Showing Granular Urethritis. (*After Fugger.*)

warmed and lubricated before its introduction, else pain and spasm will be greatly enhanced. The best lubricant is albolene with the bichloride of mercury, 1 in 1,000, in combination with 5 or 10 grains of cocaine to the ounce. Should medicated applications to the canal be required after removal of the sound, for the purpose of curing a refractory gleet, glycerine should be used for the purpose of lubricating instruments. Oils coat the surface of the mucous membrane and prevent the proper action of astringent remedies applied by the endoscope or long urethral syringe.

Medication is often necessary during treatment by dilatation or after the stricture has apparently been removed by dilatation or cutting. The cure of a stricture is often only a necessary preliminary to the local treatment of an obstinate gleet. The accompanying illustration (Plate 5) shows the peculiar granular state of the mucous membrane which frequently attends urethral stricture. Obviously, the cure of the stricture alone is not sufficient to cure the morbid state of the canal. Instillations of the nitrate of silver, five to twenty grains to the ounce, are most valuable in curing this state of affairs. The illustration shows the futility of attempting to cure a gleet by urethrotomy alone, in cases complicated by granular urethritis. Posterior urethritis is often a cause of the perpetuation of gleet after the cure of stricture, and requires very careful treatment by deep instillations of antiseptics and astringents.

The endoscope is of great value in the diagnosis and treatment of morbid states of the urethral mucous membrane complicating stricture. The use of the deep urethral syringe is often invaluable as an adjuvant to dilatation.

# CHAPTER X.

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## UNTOWARD EFFECTS OF DILATATION.

URETHRAL FEVER — HAEMORRHAGE — FALSE PASSAGES —  
ACUTE INFLAMMATION OF THE URETHRA, BLADDER  
AND EPIDIDYMIS.

*Urethral or Urine Fever* is an omnibus term applied to certain morbid phenomena which occasionally follow operations upon the genito urinary tract. These phenomena frequently follow simple dilatation, indeed a slight operation is often productive of serious results, in cases in which severe operations are well borne.

The greatest discrepancy exists in the statements of various authorities regarding the pathology of the polymorphous disturbances known by the various terms of urethral, urinary, (Guyon) and urine fever. This I firmly believe to be due to the fact that these terms are applied in a hap-hazard manner to several distinct types of disease consequent upon diseases of, and operations upon, the genito-urinary apparatus; and I am positive that a careful survey of the clinical evidence upon the subject will bear me out in this opinion. Urethral fever, as the term is ordinarily used, is, so to speak, a blanket term as broad as the mantle of charity, which comprises a series of widely varying phenomena following chronic disease, or accidental or surgical trauma of the genito-urinary tract. Fallacious as the nomenclature of these phenomena may seem to be, we are compelled to select some comprehensive term by which they may be recognized. The term *urine fever* as suggested by Reginald

Harrison is perhaps the most accurate.\* Unfortunately, however, even this term is suggestive only of one element which may act as a causal factor in the production of the morbid phenomena which we are about to consider. Harrison has adopted this term because of his opinion that the so-called urethral fever is invariably due to morbid changes in the urine at the site of injury, these morbid changes giving rise to the development of toxic materials, which, when absorbed into the circulation are always inimical to health and often productive of a fatal result. Whatever the cause or causes of urethral fever may be—and this we will consider later on—the subject is one of the greatest practical importance to the surgeon, for the various phases of this complex affection constitute the principal danger of operations or injuries of the urethra, prostate and bladder.

It should be apparent to the clinician that the omnibus term urethral fever, has been made to include conditions which bear no relation to each other, save in the fact that they have the same point of departure, viz., disease or injury of the genito-urinary tract. It is obvious that nothing else justifies the prevalent nomenclature of the various phenomena resulting from operative interference with this region. Surgical shock, uræmia, nervous manifestations and sepsis following operations on the urethra and bladder, are entirely different conditions. It is true that these various states may exist in varying combinations, this does not however justify an omnibus nomenclature. How widely different are those cases in which death results shortly after the introduction of a sound, and cases of classical septæmia following genito-urinary operations; yet these distinctive types of disease are included under the head of urethral fever. Much of our recent knowledge of the subject is due to bacteriological studies, which prove conclusively that many of the cases hitherto described

\*Lectsonian Lectures, 1888.

as classical urethral fever, are due to germ infection, or the absorption of germ products, and should be designated accordingly.

From an etiological standpoint, I believe that we are warranted in dividing so-called urethral fever into 6 forms of morbid phenomena, these varieties, however, being capable of demonstration only in typical cases in each instance. They may merge one into the other and are all secondary to genito-urinary operations, chronic disease, or injury.

1. The first form, which is by far the simplest, consists of *a nervous rigor, which is not succeeded by fever*, and which follows within a comparatively short time, operations or injury. This nervous disturbance is, in all probability, due to slight surgical shock, with a resultant vaso-motor disturbance of the peripheral circulation.

2. *Traumatic or surgical fever* (ferment fever), due to the same causes, and dependent upon excessive reaction from surgical shock—perverted metabolism—in combination with decomposition of fibrin ferments. This form of fever is quite apt to be modified by a varying degree of septic infection.

3. *Toxicæmia following severe shock* with a resultant perverted elaboration of the urinary secretion and the formation of organic poisons similar to the vegetable alkaloids. Associated with this we have reflex inhibition of the function of the kidney with its attendant uræmia, and a perversion of general tissue metabolism. This we may term the typical form of urethral fever. It is sometimes complicated by convulsions.

4. Classical septæmia, which may prove fatal within a short time, or may merge into the pyogenic condition known as pyæmia, with its characteristic circumscribed and diffuse suppurations in the various organs and tissues of the body. The latter may super-

vene without the characteristic phenomena of ordinary sepsis.

5. Chronic urinary fever attendant upon obstructive diseases of the urinary organs.

6. Cases of mixed type which combine in varying degrees elements of the first four forms of the disease.

If the above classification be scientifically correct, it is not surprising that the opinions of various authorities in regard to the pathology of urethral fever vary so widely. There must be some explanation for the fact that one authority claims that these varying phenomena are invariably septic; another that they are due to ammoniacal decomposition of urine and subsequent absorption of the products; another that they are due to simple uræmia, and last, but not least—and of this theory Reginald Harrison is the principal exponent—that they are due to obscure changes in the urinary secretion, and the formation of new and as yet unisolated toxic compounds. *It is evident to every practical surgeon that none of these causes are sufficient to explain all of the cases of so-called urethral fever.* Simple absorption of healthy urine certainly will not cause the disease, nor, as has been shown by Dr. Keyes,\* will it produce even simple suppuration when introduced into the cellular tissue by hypodermic injection. We do know however, that urine in a state of decomposition, is possessed of most powerful propensities for evil—in fact, there is hardly any organic substance with which I am acquainted that is so inimical to the vitality of cellular tissue. The experience of our most eminent surgeons in cases of urinary extravasation will bear me out in this assertion. Now, there is a close resemblance between the effects of extravasation of decomposing urine and those of the poisons of erysipelas, of dissecting wounds, or even the bite of venomous reptiles, as far as their effects upon the vitality of connective tissue

\*Op. cit.

are concerned. It is obvious to anyone who stops to consider for a moment, that there must necessarily be in all cases of injury or operations upon the urinary organs, pronounced danger of septic infection. The injury, or the site of the injury, is usually such that free drainage is impossible; decomposing urine is usually present, and is productive of more or less wide-spread death of connective and cellular tissue, and there always prevail the conditions of heat and moisture. *Such an environment, as every biologist is well aware, is peculiarly favorable to the development of those minute organisms upon which septæmia and its congeners unquestionably depend.*

None of the explanations which have been given will, when taken alone, explain the fatal result which has been known to occur from the simple introduction of a smooth staff into the urethra.

There is also food for reflection in the fact that *a simple straight cut in the urethra—as, for instance, that produced in internal urethrotomy—is productive of less shock in many cases than repeated stretching of the sensitive structures of the stricture by a sound or bougie.* It is well known that an irritable, sensitive, and contractured tissue is much more safely and comfortably dealt with in any situation by complete division than by repeated attempts at stretching.

*The cure of stricture by gradual dilatation* is dependent upon (1) mere mechanical distension; (2) upon reactionary hyperæmia, with increased tissue change at the site of the organic deposit. The functions of the lymphatics and veins are increased in activity, and absorption takes place very rapidly. It would appear, then, that if the tissue be extraordinarily sensitive, as is frequently the case in organic stricture, and if there be present toxic principles from decomposing urine, or ordinary septic materials at the site of the stricture or behind it, the operation of dilatation must necessarily

be followed by a degree of nervous shock dependent upon the susceptibility of the individual and the degree of roughness of manipulation, and by a varying degree of absorption of noxious materials. The lymphatics and veins, unfortunately, have not the power of discriminating between those organic substances which are inimical to the welfare of the individual, and those which can be disposed of in a physiological manner without injury to the blood or tissues, and *they therefore take up the poisonous materials simultaneously with the products of retrograde tissue change.*

The relation of organic and functional disturbance of the kidneys to so-called urethral fever is a most intimate one. There is probably no case of long standing obstructive disease of the genito-urinary tract, which is unaccompanied by functional aberration of the kidneys, and in a large proportion of cases there occurs later on actual organic changes in the renal tissues. This condition of affairs is to be anticipated and should be given serious consideration in every case of chronic urinary disease. The immediate effects of the kidney difficulty may not be marked, because of the activity of vicarious elimination by the skin and bowels—this vicarious action of these structures constituting the means by which the system accommodates itself to the imperfect elimination of the constituents of urine. There are very few persons, even among those who term themselves healthy, in whom the bodily sewage is absolutely perfect, and it is obvious that when the kidneys perform their functions imperfectly, this condition of imperfect sewage becomes one of vital importance. When, as a consequence of operations upon the genito-urinary organs, surgical shock is produced, reflex hyperæmia of the renal tissue is quite apt to result. This causes a strain upon the circulation of the kidney, which in its impaired condition it is unable to withstand, and as a

consequence its functions are completely inhibited with resultant uræmia.

To those who are familiar with the physiology of the nervous system in its more intimate relations to visceral functions, the association of renal aberration and reflex irritation is not at all novel, but there are many who have never had this particular phase of neuro-pathology brought prominently before them. Many interesting examples of urinary suppression from reflex inhibition of renal function have been observed. My friend Dr. J. W. Long, of Randleman, South Carolina, in an exceedingly able and scientific paper on this subject before the Southern Surgical and Gynæcological Association, reported a case which is of great interest.\* "H, age seven years, complained of pain and soreness in the ileo-cæcal region, had some fever, and was confined to bed. There was complete suppression of urine for three days, the catheter being repeatedly used without getting any urine. Appendicitis was diagnosed and preparations for an operation made. Some delay occurring, the father, without my knowledge, gave one tea-spoonful of a vermifuge which contains jerusalem oak; the next morning the boy passed at stool a ball of lumbricoid worms which the father untangled and found to contain sixty of these parasites. Within twelve hours after discharging the worms, the boy passed unaided six or eight quarts of urine. He speedily convalesced." Dr. Long's remarks anent cases of this character are of especial value, and his paper will well repay careful study.

Peyrani has shown that the sympathetic nerves have a remarkable influence over the secretion of urine, galvanization of these nerves increasing the amount of urine and urea, while section of them causes both urine and urea to sink to a minimum.†

Bernard long ago proved that albuminuria can be

\*Trans. Southern Surgical and Gynæcological Assoc. 1891.

†"Flint's Physiology of Man," vol. iii Secretion, p. 281 et seq.

produced by puncture of a certain spot in the floor of the fourth ventricle.\*

Edes remarks: "Lesion of the cerebral peduncles, section, destruction, or irritation of the spinal cord, and irritation of the renal nerves, are also causes of albuminuria."†

Millard calls attention to an interesting paper by Drs. Arnand and Butte on "Neuropathic Albuminuria," presented to the Parisian Academy, and directs especial attention to the description of a type of albuminuria "characterized by pre-existing and existing symptoms in the viscera innervated by the pneumogastric nerve. The irritation to the pneumogastric in these viscera, is reflected through the vaso-motor system to the kidneys, causing albuminuria."‡

There is only too abundant proof of the dependence of renal disturbances—and especially albuminuria—upon reflex irritation. As Dr. Long states in his excellent paper, renal aberration is most liable to occur from operations in and about certain special regions—notably the abdomen and genito-urinary organs. The explanation of this fact is not very difficult to the neuro-physiologist. The intimate relation of the sympathetic ganglia through their visceral filaments of distribution and their liberality of innervation of the genito-urinary organs, with the nervous supply of these regions, is an all-sufficient explanation. Nowhere are the cerebro-spinal and sympathetic systems more closely associated than in these parts. This being understood, it is by no means surprising that injuries in these locations should give rise to reflex disturbances of co-related parts, even though the latter may be more or less distant. The functions and physiological integrity of the abdominal and pelvic viscera are dominated by the solar plexus—so aptly termed the abdominal brain—the kidneys being

\*<sub>1</sub>. Flint, *Physiology of Man*, vol. III, *Secretion*, page 281 et seq.

<sub>2</sub>. †Pepper's *System of Medicine*, vol. iv, p. 40.

<sub>3</sub>. ‡N. Y. Medical Journal, May 9, 1891.

intimately associated with the other organs through the medium of the renal plexus; the component parts of which are filaments from the solar and aortic plexuses, semilunar ganglia, and lesser splanchnic nerves. Passing into the renal substance from the renal plexus, are some fifteen or twenty filaments with numerous associated ganglia. These nerve filaments accompany the arteries. The multitudinous distribution of these filaments to the parenchyma and vascular system of the kidneys is well described by Holbrook.\* As described by this author, the nerves supplying the renal tissue are principally of the non-medullated variety, sometimes surrounding the arteries in immense numbers, encircling them around, above and below, freely branching, bifurcating and supplying all of the neighboring structure with numerous delicate fibrillæ; a plexus encircling every tubule: supplying the connective tissue extending into the layer known as the membrana propria, and even piercing this structure and penetrating into the epithelia and the cement substance between them; the nerves also give off delicate ramifications of fibres to the afferent blood vessels by which they enter the tufts and produce a delicate plexus spun around the capillaries. The distribution of nerves is richer in the convoluted and narrow than in the straight collecting tubes. Reasoning from these anatomical facts, it is not difficult to understand how irritations of the abdominal and pelvic viscera or of the genito-urinary organs, may be reflected to, and produce morbific changes in the kidneys. Hardly a case of genito-urinary disease perhaps, runs its course without some such reflex impression. The result depends chiefly upon the organic state of the kidneys; if this be bad, speedy death may result. To use a homely illustration of this point, all operative manipulations of the genito-urinary tract are

\* Paper on nerve terminations in the kidneys, before the Am. Soc. of Microscopists. Quoted by Millard. Dis. of the Kidneys.

liable to concuss, so to speak, the renal nerve supply, i.e. are likely to bring a reflex strain upon the vascular supply, and secondarily upon the nutrition of the kidneys.

Regarding reflex impressions upon the structure and functions of the kidney, Engelmann says: "Functional derangement, and finally, morbid changes, are produced by nervous influences emanating from diseased pelvic viscera. (1) As reflex phenomena or (2) by perverted nerve action by the secretory nerves due to the intimate connection of the uterine and renal plexus. Suppression of urine occurs as a reflex: more generally speaking, hysterical symptom, and may lead to pyelitis, a mild nephritis, or hydronephrosis." (?) Dr. Engelmann then cites a case in which nephritis followed spasmodic stricture of the urethra, (?) after which he says, "I believe such cases to be more frequent in connection with pelvic disease than we may suppose, as the slight symptoms produced are overlooked amid the varying pains of the primary disease." Obviously, what is true of pelvic and utero-ovarian lesions in women, is equally true of genito-urinary lesions in the male, as far as reflex functional and structural aberration of the kidney is concerned;

As regards renal disturbances after laparotomy, it has been fully established by English and others, that abdominal traumatisms are prone as a result of an impression made upon the solar plexus, to develop albuminuria. Weir relates a case of gastro-enterostomy, done for simple pyloric stenosis, as illustrative of the occasional effects of abdominal operations upon the kidney. Prior to the operation repeated examination failed to show the presence of either albumen or sugar, but within forty-eight hours after the operation one-half per cent. of albumen and four per cent. of sugar, with granular and epithelial casts, were found in the urine.

\*Trans. Am. Gyn. Society 1889.

Forty-eight hours later the morbid state of the urine had entirely disappeared. Weir seems to believe that some traumatic disturbance of the solar plexus during the operation explains the renal symptoms.

I trust that the foregoing rather voluminous expatiation upon the relation of reflex irritation to renal aberrations, may not seem superfluous, for to me it has a most important practical bearing upon so-called urinary fever, and the various accidents embraced under this omnibus term which are the *bete noir* of genito-urinary surgery.

*The subject of autogenesis in its relations to the development of certain constitutional diseases* demands more attention than is usually accorded it, and it is probable that physio-chemical researches in this direction, will in the future shed new light upon many diseases, the etiology of which is now obscure. Among the modern writers who have given considerable attention to the morbid results of perverted physiological chemistry, Benjamin Ward Richardson is perhaps the most prominent. It is to the researches of this author that we are indebted for the most widely accepted theory of the pathology of rheumatism. *It is probable that perverted tissue metabolism bears a causal relation to the typical cases of urethral fever.* This perverted physio-chemistry may quite readily be brought about by surgical shock, this being especially marked in the glandular tissues. We know quite well that mental emotions of various kinds and those impressions upon the nervous system which result in the condition that we term "shock" may produce marked changes in the physiological secretions of the body, these changes consisting either in an increased or diminished flow, or obscure chemical changes of composition; thus we may have through various nervous impressions an increase or decrease in the quantity of the saliva, the lacteal secretion, the gastro-intestinal secretions, the urine and of the menstrual flow.

A familiar illustration of the chemical effect of various emotions upon physiological secretions, is the change in the quality of the lacteal secretion, induced by fright, anger or grief. This change, although occult and incapable of demonstration by microscopical or chemical research, is most pronounced in its morbid effects upon the child; cholera infantum of a most fatal character being a frequent sequel to the emotion of anger in the mother. *Precisely what this change in chemical composition may be is an open question, but it is possibly a species of decomposition which results in the formation of a poison analogous to the "tyrotoxicon" discovered by Prof. Vaughn in impure cow's milk.* It is well known that great care is necessary on the part of those who supply milk for the use of infants, to prevent fatigue and various sources of excitement in the cows from which it is taken. It is well known, too, that sexual excitement in the cow is productive of marked changes in the milk, and renders it unfit for human food.

If the changes above indicated occur in one secretion, it is highly probable that all of the physiological secretions are susceptible to them. It is probably true in the case of the saliva, that the emotion of anger causes the development of toxic principles in that secretion, and this may possibly explain the serious results that are so apt to ensue from the bite of an enraged human being.

The difficulty of proving this theory in the present state of our knowledge of physiological chemistry, is obvious. In the case of the urine the influence of surgical shock may be inferred to consist in the development of organic poison in that secretion. This may be considered to be hypothetically analogous to the ptomaines and leucomaines discovered by Selmi and Gautier in both dead and living bodies, and which so closely resemble the vegetable alkaloids, particularly

nicotine, brucin and strychnine.\* The toxicæmia resulting from such changes will perhaps explain the otherwise obscure and mysterious cases of death following the simple introduction of a sound.

In some cases the development of uræmia or toxicæmia is very gradual, and results from successive operations upon the urethra. *The poisonous materials may accumulate in the system for some time and their presence fail to manifest itself until the system, so to speak, is ready for the explosion,* when a previously well tolerated and comparatively slight irritation of the genito-urinary apparatus will be sufficient to develop a serious result.†

The following case illustrates the point just made: A competent surgeon of this city had performed urethrotomy upon an apparently healthy young man of 28 years of age. The stricture was located about three-fourths of an inch posterior to the meatus and was divided under cocaine without any difficulty or pain whatever, each subsequent operation of dilatation being preceded by the injection of a four per centum solution of the muriate of cocaine, the quantity used being about two fluid drachms. About a week after the urethrotomy, the patient complained of considerable nervousness and insomnia, but this was not considered of any particular importance. On the 9th day an attempt was made to perform the usual operation of sounding and injection of cocaine, the patient meanwhile lying on an ordinary surgical chair. The doctor left the patient for a moment to obtain his sound and to give the cocaine an opportunity to affect the urethra. He was called back in about a minute by the patient, who complained of dizziness, and immediately fell back in the chair in convulsions. Assistance was called, stimulants were given,

\*Harrison believes that such compounds may develop in the urine, under certain circumstances. R. Harrison, Op. cit.

†Sir Andrew Clark has also recently suggested that "catheter fever" may be due to some nutritive disturbance due to reflex nervous influences. Meeting of Brit. Med. Ass'n. Aug. 1888.

and the galvanic current used, but without avail, the patient dying in something less than five minutes.

At the post-mortem a thorough examination of all the vital organs was made, but everything was found perfectly healthy, with the exception of the kidneys, which were so extremely congested that they presented a bluish appearance similar to that of the spleen. *This fatal result was surely not attributable to the cocaine, but was evidently due to the sudden explosion of poisonous materials which had been gradually accumulating in the system as a consequence of imperfect action of the kidneys and the metabolic action of slight surgical shock upon the tissues.* This condition of toxicæmia gradually grew more pronounced and finally was so severe that a comparatively slight irritation was sufficient to inaugurate a nervous explosion. Such an irritation was afforded by the mechanical effect of the injection of cocaine, and it is probable that the introduction of simple water would have had a similar effect.

*The danger of the development of urethral fever is directly proportionate to the depth of traumatic and surgical injuries of the urethra i. e. their distance from the meatus.* Those situated in the pendulous portion of the urethra are not, as a rule, very dangerous as compared with those situated in the fixed or deep portion of the canal. The explanation of this is very simple, the nerve supply of the deep urethra being much more abundant and sensitive, the cellular tissue more abundant, and the opportunities for drainage much less favorable than in the pendulous urethra. Decomposing urine is less apt to remain behind a stricture in the pendulous portion of the canal than in the deep portion, this being due to simple gravity and to the fact that strictures of this portion of the canal are usually of large calibre. Urinary extravasation in the pendulous portion of the urethra is not apt to produce serious danger to life, inasmuch as the connective tissue in this situation is very

sparse and the extravasated fluid is likely to be detected before it has burrowed back into the perineum.

The relation of germ infection, or the absorption of the products of germ evolution, to the septic varieties of urethral fever is a most important one. This is abundantly proven by the researches of Guyon, Clado, Krögius, Albarran and many others,—investigators whose testimony is unimpeachable.

The clinical features of the various morbid phenomena included under the head of urethral fever require some special consideration:

*The nervous form* of the disease usually appears in patients of an impressionable constitution, or who, in other words, present a decided tendency toward neurotic disturbances. Oftentimes its occurrence may be anticipated by the behaviour of the patient while he is under instrumentation. He is quite apt to have nausea, perhaps vomiting, slight rigors, partial or complete orgasm, or more or less complete syncope during the introduction of instruments in the deep urethra. Such patients are apt to develop, within twenty-four hours after urethral operations or injuries as a rule, a sharp chill. This lasts for a variable time, being rarely prolonged, and then disappears, leaving the patient about as well as before, with the exception perhaps of more or less mental depression. Rarely indeed, there may be a slight amount of fever or sweating. The chill may come on within a very few minutes after the operation.

*The traumatic form* is the most common; it manifests itself by a sharp chill, usually within twenty-four hours after operations or injuries of the genito-urinary tract, and is followed by pronounced fever and sweating. The disturbance either passes off after a single paroxysm, or is followed by a period of general malaise, with perhaps a recurrence of the paroxysms for several days. In these latter cases there is present in all probability a slightly septic element.

*The third form—the typical urine fever*—may or may not be attended by a violent chill coming on within twelve to thirty-six hours. There are marked prostration, violent vomiting and diarrhoea, coldness of the surface of the skin at first, succeeded by more or less febrile movement of temperature later on if the patient survives, with suppression of urine, merging in a very short time in fatal cases into coma of an apparently uræmic type. *I say “apparently uræmic type” because according to the theory I have advanced regarding the action of shock upon the urine, there is probably in many cases a toxic element present which is independent of uræmia.* Cases of this kind may come on gradually and manifest themselves by a sudden explosion in the form of convulsions, as is illustrated by the fatal case that has just been related.

*The fourth or septic form* of urethral fever manifests itself usually by a slight (but sometimes by a very severe) chill: this is followed by fever of a varying degree of severity. The patient may sink into a typhoid condition, or become comatose, and die within from two to ten days from acute septicæmia, or the condition may be subacute and merge into the pyogenic form of septæmia, known more familiarly as pyæmia, in which event the patient finally succumbs to the slow development of circumscribed or diffuse purulent deposits in the joints, viscera and other structures of the body, dependent upon infection with pyogenic microbes and their products.

*The fifth or chronic form of urine fever* may be described as a chronic condition of toxicæmia and nervous irritation produced by long continued obstructive and inflammatory affections of the genito-urinary tract. This condition of toxicæmia and general nervous irritation is one which is not generally recognized, but which is very important in its relations to chronic genito-urinary disease. It exists in the majority of cases of

organic stricture of long standing, in old men suffering with prostatic hypertrophy, in tumors of the bladder, in chronic cystitis from whatever cause it may arise and in pyelitis, particularly the form due to the presence of nephritic calculi. There is a marked tendency in patients suffering with these affections to a mild form of hectic fever; flushing of the face with slight elevation of temperature and perhaps followed by a certain degree of perspiration, are quite common; nervous irritability is especially marked. Indeed, there are few conditions that are productive of so much mental depression and of so much irritability of temper as chronic diseases of the genito-urinary tract. The old man with a vesical calculus or prostatic hypertrophy, or for that matter, the young man with a stricture, is apt to be unreasonably morose and irritable. In all of these cases there is apt to be present more or less obscure rheumatic or neuralgic pains in various situations. After prolonged retention of urine from any cause whatever, it will be found that the majority of patients will suffer for a few days or weeks from more or less marked elevation of temperature.

The different general conditions which have been outlined are due in my opinion to a toxicæmia which is dependent upon (a) imperfect elimination of the products of retrograde tissue metamorphosis; (b) to a greater or less degree of absorption of morbific materials produced by inflammation and the decomposition of residual urine behind the site of obstruction i. e. pseudo-alkaloidal germ products. It will be observed that many patients suffering from chronic genito-urinary disease of an obstructive or chronic character, fail to realize how sick they are until the diseased condition has been removed, or at least greatly improved; they then find that slight disturbances to which they had paid comparatively little attention and which they had never dreamed of attributing to their

urinary trouble, have disappeared. This is due in great measure to the fact that reflex nervous irritation has been relieved, but more than this, it is due to the fact that the constant absorption of poisonous materials from the site of disease or above it no longer occurs.

I have designated a sixth or mixed form of so-called urethral fever. It is probable that few cases will be met with that cannot be assigned to one or the other of the first five varieties of disturbance that have been described; it is to be expected that cases will occasionally occur in which there exists in varying proportion evidences of septic disturbance and of uræmia, with possibly a tendency to disturbance of the nervous functions. A clinical differentiation might in such cases be impracticable.

It is obvious that the range of cases which may properly be classified as urethral or urine fever is rather limited. Those cases resulting from septæmia and surgical shock are certainly improperly so classified.

It has been my experience that patients suffering from paludal poisoning, are especially apt to develop chill and perhaps fever, after genito-urinary manipulations.

#### TREATMENT OF THE CONDITIONS USUALLY TERMED URETHRAL FEVER.

*The principal measures of treatment of the morbid phenomena following genito-urinary operations are of a prophylactic character, for unfortunately for the patient, the marked forms of the disease i. e. the septic and uræmic varieties, are seldom recovered from.* The principal feature of prophylaxis should consist of strict attention to the principles of genito-urinary hygiene. If the functions of the kidney are stimulated by alkaline diuretics, and the skin and bowels kept in an active condition, thus affording vicarious relief to the kidney, the patient is placed in the best possible condition to

avoid those complications which have been described. In addition to these measures, moderate doses of anti-septic drugs may be given internally. Of these, boric acid in ten grain doses, as recommended by that excellent authority, Professor Palmer, of Louisville, is one of the best.\* Salicylic acid or preferably the salicylates of soda, and the oil of eucalyptus are admirable remedies. Local antisepsis in cases of chronic bladder and prostatic disease is of course essential and can be accomplished by irrigation with mild antiseptic lotions, such as carbolic acid, borate of soda, or boric acid, potassium permanganate and the bichloride of mercury. The surgeon should avoid operating upon cases complicated by structural renal disease if it is possible to do so; if an operation be unavoidable he must not only be very careful in his manipulations, but should throw the responsibility of the result entirely upon the patient and his friends. Prior to operative interference, particular attention should be paid to the urine and to local antisepsis. The patient should be put to bed and instructed to remain perfectly quiet; he should be placed upon a milk diet and moderate doses of quinine; 5 grains three times daily, for a week or ten days previous to the time appointed for the operation, being about the required dose.

Various drugs have been recommended for administration just before or at the time of urinary manipulations or operations. Quinine and morphine in ten and one-fourth grain doses respectively are the most popular remedies and unquestionably have a conservative effect by increasing the resisting power of the nervous system and thus lessening the liability to shock. Jaborandi is also recommended for the same purpose, and inasmuch as its physiological action is such that it must necessarily relieve any strain upon the kidney, this drug

\*It would seem proper that Dr. Palmer should receive credit for the introduction of this remedy as a urinary antiseptic. For some reason he has not in certain quarters, received the credit due him.

seems to me to be one of our most philosophical remedies. Hypodermic injections of the muriate of pilocarpine may be given instead of the fluid extract of jaborandi, and in case uræmia supervenes this method of administration is absolutely essential. Diuretin has been highly endorsed by Dr. Keyes.

The milder cases of disturbance (the nervous and traumatic forms) are rarely fatal, but may possibly lead to the severer forms of the disease and consequently require our attention. The administration of opium and jaborandi, with perhaps (in the traumatic form of the disease) aconite or veratrum viride constitutes the best treatment at our command. If uræmia occurs, our attention should first be directed to the vicarious elimination of urea, for we cannot afford to waste valuable time in attempting to restore the functions of the kidney within the first few hours after the supervention of uræmia, particularly if coma has occurred. Pilocarpine will act upon the skin, even when the patient is in a comatose condition, and it should be given freely. The bowels should be moved by croton oil, two or three drops of which in combination with five or six drops of olive oil, may be placed upon the back of the tongue. If the patient is able to swallow, elaterium in doses of from one-eighth to one-third of a grain is preferable to all other hydragogue cathartics. Hot baths should be given and dry or wet cups applied over the region of the kidneys. Digitalis may be given internally as a diuretic after the emergency is over, *but it is bad practice to attempt to accomplish anything by diuretics before vicarious elimination of urea has been attended to.*

Urethral irrigations with solutions of bichloride, 1 in 20,000, before and after manipulations of the canal will prevent in the majority of instances the occurrence of septic infection after genito-urinary manipulations.

Measures to insure a perfectly aseptic condition of

the instruments used for exploration and dilatation of the urethra constitute an important means of prophylaxis of septic manifestations. Sounds when introduced should be carefully warmed and lubricated with some antiseptic substance, and care should be taken that they are perfectly smooth.

When septicæmia or pyæmia develops in spite of all our precautions, very little can be done in the majority of cases beyond supporting the powers of life by free stimulation, a fatal result being almost inevitable. It is however, the duty of the surgeon to attempt to avert a fatal result by incision and drainage where possible, and if the case is clearly septic, a free incision at the site of the stricture or a perineal or supra-pubic cystotomy in cases of bladder and prostatic trouble, constitutes the proper surgical procedure.

The management of cases of chronic urinary toxæmia consists in local antisepsis by irrigation, and the prompt removal of the organic conditions upon which the gradual and constant septic infection depends.

*Nervous manifestations* attendant upon the introduction of a sound and bearing a certain relation to so-called urethral fever are so frequently seen that they are worthy of special consideration, even at the risk of some repetition of points embraced in the preceding general discussion. There exists in some individuals of a nervous temperament extreme hyperæsthesia of the urethral mucous membrane, and particularly that of the prostatic portion of the canal. The nerves of sexual sensibility are apparently involved in the hyperæsthesia and enter into the causation of the direct and reflex nervous results of instrumentation. Shivering, a sense of faintness, cold perspiration and perhaps nausea, are not infrequently noted during the passage of instruments into the bladder. These symptoms usually begin as soon as the instrument enters the

membranous urethra, and increase as the neck of the bladder is approached. They usually pass off immediately, but may recur and constitute the nervous form of urethral fever already described.

The precise cause of these nervous manifestations would be difficult to determine. They are probably due in the first instance to an impressionable nervous system and timidity. They may, however, occur in individuals of strong constitution and of undoubted physical and moral courage. There is nevertheless no question but that a dread of the operation of dilatation has much to do in the causation of the nervous phenomena described. I have found, for example, that severe pain and spasm usually occur in individuals who have a dread of the treatment, and in such patients considerable depression following the operation is by no means unusual.

In this connection it is well to remember the intimate association of the nervous supply of the genito-urinary tract,—and particularly the parts about the neck of the bladder and prostate,—with the sympathetic ganglia. It is certainly true that in some individuals relatively slight disturbances of these parts produce a most profound and depressing effect upon the sympathetic nervous system, and incidentally upon all the vital functions. The modus operandi of such disturbances is probably through a reflex impression made upon the sympathetic ganglia, through irritation of the nerves of sexual and general sensibility supplied to the parts involved. Conversely, it will be found that stimulation of this region within certain limits has a decidedly stimulating and even tonic effect which is beneficial to the general system. There are many disturbances of a nervous character, which are purely reflex and referable to irritations of the sexual apparatus independently of the previous existence of actual inflammation in these parts. As a matter of common experience it is noted

that inflammations about the neck of the bladder and prostate are attended by relatively greater constitutional depression than similar morbid conditions of apparently much greater importance, located in other situations. This is only explicable upon the theory of the reflex impression produced upon the sympathetic nervous system.

Urinary fever—and even minor nervous disturbances,—very rarely occurs in women, in whom the urethra is relatively much more insensitive than in the male. Then, too, the seat of sexual sensibility is not located in this portion of the female anatomy. Erichsen states that he has only once seen symptoms of urethral chill in the female. This was in the case of a young married lady, strong and healthy, who had a stricture of the orifice of the urethra which he dilated by a two-bladed dilator. Twenty hours after the operation she had three most intense rigors, followed by profuse sweating.

*The liability to nervous and febrile disturbances following instrumentation of the urethra is modified to a great extent by the location of the morbid condition which is being treated.* Dilatation of stricture in any part of the urethra may produce such phenomena, but they are most likely to occur after operation upon strictures in the deeper portion of the canal, not because—as has been erroneously stated by some—the deeper portions of the canal are more commonly strictured, but because these parts are more closely associated with the nerves of sexual sensibility and with the filaments supplied by the sympathetic system.

Erichsen speaks of one case in which a fatal chill followed incision and dilatation of the orifice of the urethra. A case of this kind might occur as a result of reflex inhibition of the function of the kidneys produced by nervous shock. It is well known that strictures at the meatus often produce serious nervous disturbance, reflex spasm and vesical troubles, and it is

conceivable that an operation upon this sensitive part might have a very profound effect upon the nervous system in some cases. Such an effect, no doubt, might result in reflex hyperæmia of the kidneys with complete inhibition of their functions and the supervention of uræmia, following the purely nervous manifestations induced by the operation.

Urethral chill and fever are not very often met with unless some lesion of the mucous membrane exists, showing that a large proportion of these cases are due to the absorption of some toxic material.

It is well to remember that, independently of all theoretical reasoning as to the precise causation of the various forms of urinary fever, there are certainly three elements to be considered, viz: (1) An impression of a purely nervous character; (2) a condition of toxæmia due to the absorption of septic materials from the affected mucous membrane, and (3) a toxic condition of the blood incidental to the retention in it of the products of retrograde tissue metamorphosis incidental to inhibition of the function of the kidneys, and which in lieu of a better term we call uræmia. These three elements may exist singly or combined. *When the condition goes beyond a purely nervous impression there may be a combination of all three elements.*

It has been noticed that the use of metallic instruments is more liable to produce chill and subsequent manifestations of urinary fever than are the soft varieties. The only reason for this that I can suggest is that the soft instruments are used in comparatively small sizes and their introduction is so easy that it would be a bungling operator indeed who could succeed in producing injury; whereas even in skillful hands the use of the steel sound or a metallic catheter is likely to produce a relatively marked disturbance of the normal mucous membrane and of the lesion. The majority of surgeons who introduce instruments into the urethra

are by no means extraordinarily expert in the necessary manipulations, and are therefore more likely to produce injury with a stiff and inflexible instrument than with one which is intrinsically harmless like the soft bougie.

It is to be remembered that, as already suggested, *a condition of chronic uremia underlies many of the cases of rigor and fever following instrumentation of the urethra.* The nervous system under such circumstances is in a perpetual state of irritability, and it is only necessary for some slight shock to occur to precipitate a nervous crisis. This shock is afforded in some instances by even the most delicate manipulations of the canal.

The occurrence of the various symptoms which have been described, may be prevented in a large proportion of cases by gentleness in manipulation, and a careful study of the condition of the case at the time of each instrumentation. Like other accidents occurring in the course of treatment by dilatation of the urethra, much may be done in the way of prophylaxis, by careful observation of the exigencies of each particular case. Routinism is quite apt to be attended by annoying or even disastrous results. It would not be at all surprising if cases of urethral fever should arise in the practice of an individual, who, regardless of the effects of previous instrumentalations, and of the local and general conditions prevailing at the time of operation, dilates all cases of stricture in a routine fashion every second or third day. The condition of the stricture itself as regards irritability has much to do with the liability to the development of nervous manifestations following attempts at dilatation. Given a highly irritable state of the contracted tissue, a primarily susceptible nervous organization, and chronic uræmia in combination with unskillful attempts at instrumentation, and urethral chill—and perhaps fever—is almost inevitable.

The administration of anodynes, the use of hot

baths, diaphoretics and other derivative and eliminative measures of treatment, with the careful use of cocaine in mild solution and moderate quantity at the time of the operation, are very useful in the prevention of disagreeable nervous results. The administration of morphia just before the operation in very sensitive patients—or just after the operation as a matter of routine, until the tolerance of the patient for instrumentation has been established—is a very useful measure. Quinine, morphia, jaborandi—and perhaps diuretin—are the only remedies which are generally recognized as valuable in the prevention of urethral chill, and it is noteworthy that they are all remedies which act selectively, so to speak, upon the nervous mechanism. Eucalyptus, however, I know to be of great value, especially where the malarial cachexia exists. The use of hot antiseptic irrigations of the canal before and after operation in cases in which the phenomena of urinary fever are to be apprehended, is a very rational procedure, as has been already suggested. Where the operation of dilatation produces severe shock it may be necessary to administer hot toddy, or some other form of stimulant. I have found that the use of the Mariani wine of coca is beneficial to patients of a very impressionable temperament.

*When it is found that serious nervous disturbance or urethral fever follows each operation of dilatation, some other and more radical measure of treatment must be substituted for it. A radical operation by divulsion or urethrotomy in such cases is far safer than dilatation and constitutes the only feasible method of cure.*

Regarding the possibility of the occurrence of nervous manifestations from the introduction of a sound, it may be well to reiterate one point, which is that the surgeon should avoid the introduction of an instrument with the patient in the standing posture, until the degree of tolerance of the nervous system has been thor-

oughly established. It is a very unpleasant thing to have a patient fall upon the floor in a dead faint while an instrument is being introduced—an accident by the way which has happened to me several times, in cases in which, for the sake of convenience and for the purpose of economizing time, I had ventured to introduce an instrument with the patient in a standing posture.

Extreme sensibility of the urethra, and incidentally of the nervous system, are very frequently observed in cases in which the urethra is being operated upon for the first few times. This local and general hyperæsthesia, however, becomes blunted as a consequence of the local and constitutional effects of instrumentation within a comparatively short time, and after a few *seances* it will be found that the operation will be well tolerated. In some exceptional cases, however, the urethra remains permanently intolerant of the introduction of instruments, and no matter for how long a period the treatment may be continued, severe spasm, nervous shock and perhaps rigors will be produced by instrumentation.

#### HÆMORRHAGE AND FALSE PASSAGES.

*Hæmorrhage* is a frequent result of the introduction of instruments for the cure of stricture. As a rule, however, I think that its occurrence is an indication that undue force has been used. In nine cases out of ten, when the operation of dilatation is productive of hæmorrhage it may be inferred that the instrument used is too large or that too much force has been used. An instrument which will enter the bladder by its own weight will very rarely produce bleeding, as the separation of the stricture tissue is accomplished in a very gentle manner and the pressure exerted is very moderate. In very tight strictures, and in those in which there is considerable congestion and spasm, the introduction of any instrument, however small, is liable to produce hæmorrhage. When, therefore, I find that

the introduction of an instrument which will enter the bladder without the employment of force, is followed by bleeding, I infer that there exists considerable congestion at the site of the stricture. The hæmorrhage *per se* is not injurious, but on the contrary is very beneficial by producing local depletion. If, however, it results from forcible catheterization, the reaction following the traumatism produced by the instrument more than counterbalances any possible benefit which could be derived from the local abstraction of blood.

Some cases in which congestion exists as a predominating condition, will bleed occasionally after the act of urination, and particularly if the patient has recently indulged in intercourse, or has become sexually excited. Strictures of this sort are particularly apt to occur in intemperate individuals, or those who have suffered from syphilis. Under such circumstances the utmost gentleness in the introduction of instruments will not prevent the occurrence of more or less bleeding. It is rarely if ever necessary to treat the hæmorrhage; in fact it should be allowed to continue within reasonable limits. Should it however become excessive, the application of the cold water coil or an ice-bag will be all that is necessary to check it.

*False passages* are a more frequent result of the introduction of sounds and bougies than is generally believed. They are produced by the passage of the instrument through the urethral walls into the surrounding tissues. The mucous membrane only may be torn up—in which case the passage rarely extends for a great distance—or the corpus spongiosum may be entirely penetrated and the tissues of the perineum entered. The danger of their occurrence is greatest with small metallic instruments, it being difficult to produce them by means of flexible bougies or catheters. The common

English catheter with the stylet is, however, nearly as dangerous as metallic instruments.

In pack thread or bridle strictures numerous pockets are apt to exist in the canal, or there may be a sort of membranous diaphragm thrown obliquely across the urethra in such a fashion that the instrument impinges upon it at its junction with the urethral walls, instead of entering the orifice of the stricture. Under such circumstances the conditions necessary to the production of a false passage are very favorable, and it takes but little force to perforate the urethra.

#### SYMPTOMS.

The occurrence of this accident is usually quite evident at the time of operation. The surgeon is usually conscious of having used considerable force, or of carelessness in respect to conforming the instrument to the natural direction of the urethra. The obstruction suddenly yields to the pressure, and the direction of the handle of the instrument demonstrates the fact that the point is thrown out of the proper line. If the handle of the instrument be rotated between the thumb and fingers, it will be found that the point is fixed, thus showing conclusively that it cannot have entered the bladder. When the bladder is entered in the proper manner the point of the instrument is usually freely movable within the cavity of the organ, and there is no sense of resistance imparted to the handle when it is rotated.

Under very exceptional circumstances the instrument may not only be forced through the urethral walls into the tissues outside it, but may be passed completely on until the bladder is perforated. Coincidentally with the alteration in the direction of the instrument the patient complains of severe pain and perhaps a sense of impending syncope, and is apt to assert that something has been torn. Free bleeding almost invariably

results. If a rectal examination be made, the beak of the instrument may be detected in the connective tissue lying between the vesical and rectal walls.

False passages are most usually formed in the deep urethra, as it is in this situation that the lever action of a sound can be exerted to the best advantage, and moreover it is here that strictures so tight as to demand the use of small instruments are usually found. It is not so easy to produce false passages in the pendulous urethra, as the point of the instrument is continually under the control of the fingers, and its proper direction is very easily maintained. The danger of their occurrence should, however, be borne in mind.

The danger of false passages is directly proportionate to their distance from the meatus. Their direction is usually to one side of the canal. They may however perforate beneath it or above it. When they occur above it they are not likely to penetrate for a great distance, on account of the firmness of the tissues. The corpus spongiosum, or even the prostate, may be completely perforated when the false passage occurs below.

The character of the perforation has also much to do with the degree of danger. When the false passage enters the corpus spongiosum and runs along the urethra, perhaps to open again into the canal, or if the bladder be entered after a lateral lobe of the prostate has been perforated, the danger to life is comparatively slight. When, however, it passes clear outside the corpus spongiosum into the vesico-rectal areolar tissue, serious extravasation of urine may result, with the consequent occurrence of inflammation, suppuration and perhaps gangrene of the tissues. These accidents are very frequently fatal.

Old false passages are an occasional very annoying complication of stricture, and very frequently interfere not only with the treatment, but prevent a perfectly successful result as far the relief of the symptoms is con-

cerned, even though the calibre of the canal be restored. As a rule, the history elicited from the patient is sufficient to justify a suspicion of the formation of a false passage or passages, at some previous instrumentation. The abnormal direction of the sound, the failure to enter the bladder, and the peculiar gristly sensation imparted to the instrument are often sufficient to indicate its existence. Oftentimes the patient is perfectly aware of the presence of false passages, and will so inform the operator. Occasionally he will know that the abnormal channel has been penetrated by the instrument when its course is not evident to the surgeon. In some instances, only the most careful study of the symptoms and course of the case under treatment will enable us to determine the existence of false passages.

*Inflammation* of an acute character affecting the urethra, prostate, bladder and epididymis, is by no means infrequent as a complication of stricture, arising as a direct consequence of injury produced by instrumentation. There is of course, following all efforts at dilatation of a stricture, a moderate amount of resultant inflammation. This inflammatory reaction however, may be limited to the stricture itself. There may occur on the other hand, quite a sharp attack of urethritis. Much depends on the condition of the urethra at the time of dilatation; of more importance, however, is the condition of the sound as regards cleanliness.

Inflammation of the prostate, incidental to the rough or careless introduction of instruments, or for that matter, to the careful passage of very large instruments, is an occasional result of dilatation. It should be remembered in this connection that the prostate is invariably in an irritable and perhaps congested and enlarged condition, as a secondary result of the stricture, or rather as a consequence of the bruising to which the organ is subjected during the frequent and spasmodic efforts at urination which are required for

the evacuation of the bladder. In the presence of this condition of affairs comparatively slight traumatism is sufficient to excite prostatitis. This may appear in an acute form as a consequence of a single act of violence, or it may appear in a subacute or chronic form as a result of repeated bruising and irritation. Abscess may occur, especially if infection be produced by a septic sound.

Cystitis in the course of stricture arises in several ways: (1) It may be due to actual violence done to the neck of the bladder by the use of large instruments. (2) It may occur as a consequence of irritation produced by the prolonged contact of instruments, whether soft or metallic, with the neck of the bladder in the treatment by continuous dilatation. Ulceration of the bladder walls may result in a similar manner, as a consequence of pressure produced by the point of the sound. (3) Pre-existing chronic cystitis of the vesical neck, due to direct extension of inflammation from the stricture, may be so enhanced by the irritation produced by the introduction of instruments that acute generalized cystitis and perhaps pericystitis results. (4) A small quantity of poisonous material which is formed by bacterial evolution posterior to the stricture in the dilated portion of the urethra, is carried by the point of the instrument into the neck of the bladder and there sets up acute inflammation.

*The relation of bacterial organisms—not necessarily specific—to the morbid processes at the site of stricture and to cystitis is a very important one.*

(5.) Poisonous material, *i. e.* bacterial organisms or their products, may be conveyed to the bladder through the medium of unclean instruments.

*Epididymitis* is one of the most frequent complications of stricture. It may be produced in two ways: ( $\alpha$ ) by the production of acute inflammation at the site of the stricture, which extends down to the mouths of the

ejaculatory ducts and thence to the epididymis. (*b*) By the conveyance of organic poisons to the mouths of the ejaculatory ducts by means of the sound or catheter.

These various complications of stricture may be avoided in most instances if the patient keeps quiet, is temperate, and follows directions implicitly, and more important still, if the surgeon is gentle in his manipulations and absolutely cleanly as regards his instruments. It is desirable for patients who are being treated for stricture to wear a suspensory bandage throughout the course of the treatment if the testes be at all sensitive, this measure being very valuable in preventing epididymitis.

# CHAPTER XI.

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## OPERATIVE TREATMENT OF STRICTURE.

### DIVULSION.

*Divulsion of stricture* consists of its rapid and forcible dilatation with the object of rupturing the morbid tissues. It originated, in all probability, in England, where it is still a very popular operation.

Various instruments have been devised for the operation of divulsion. Some of these consist of sliding tubes of varying calibre which are forcibly introduced over a central guide. Another variety splits the stricture after the fashion of a wedge. Still another, and the most popular variety, consists of several parallel blades separable by means of a powerful screw.

Divulsing tubes were first used by Desault something like a hundred years ago. They are used in the following manner: A small bougie is introduced into the bladder as a guide, over this an open-ended catheter is passed, and over this another catheter or tube a trifle larger, as much force as is necessary being used. A succession of tubes of increasing size are passed until the urethra is dilated to its fullest capacity.

Divulsion upon the wedge principle was first recommended by Reybaud, and has been modified to a certain extent by Mr. Holt of England. Holt's instrument consists of two grooved blades of strong metal joined at their points. Between the two blades and fastened to them at their point of junction is a wire which acts as a guide; over this wire a tube of considerable size is forcibly passed. This separates the blades and splits

the stricture. It is claimed by Holt that the rupture produced by the instrument does not extend beyond the morpid tissue, the healthy urethra not being injured about it. The accuracy of this statement is certainly questionable. I do not believe it possible for a stricture of any extent to be ruptured without injury to the urethra.

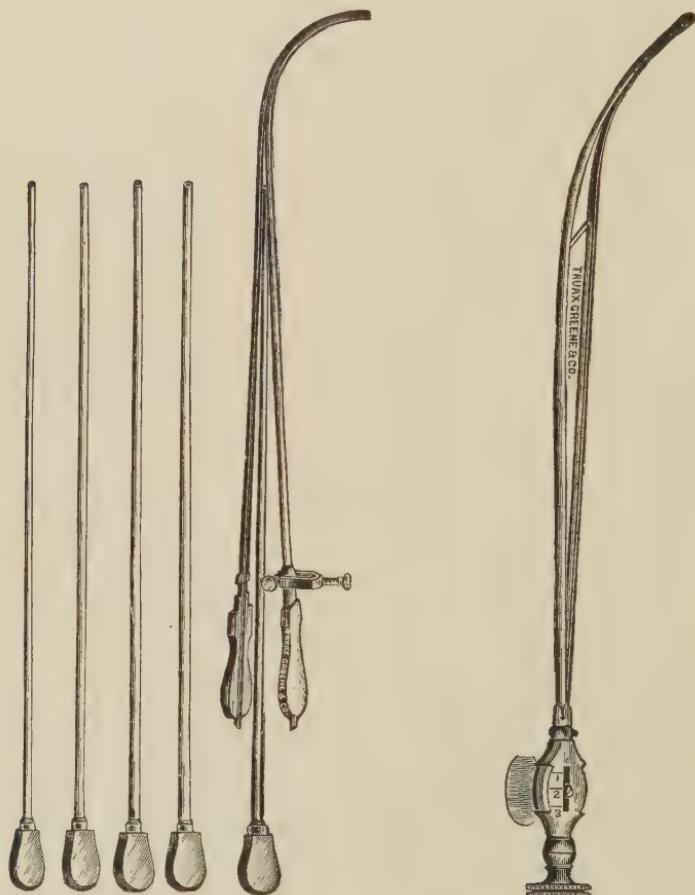


Fig. 58. Holt's Divulsor

Fig. 59. Thompson's Divulsor.

Divulsors with separable blades are the most popular instruments for the purpose of rupture of strictures.

Various patterns of the screw divulsor have been devised; they have been made with two, three and four blades. The best divulsor is probably that of Sir Henry Thompson, which has two strong, separable, parallel blades. This instrument may be used for the purpose of rapid dilatation, by slowly separating the blades with successive turns of the screw, or it may be used to rupture a stricture by rapidly separating the blades as as possible. When the operation has been slowly done there is very little bleeding, and in all probability little or no laceration of the wall of the urethra. It is not apt to be successful, however, unless complete rupture is produced, in which event there may be considerable bleeding.



Fig. 60. Gouley's Rapid Dilator.

DivulSION at the present time is not very popular among the leading surgeons in America. It still however has many advocates in England and on the continent, where urethral surgery is far behind that of America. The operation appears to me to be a very unsurgical one, and unless considerable damage is done at the site of the lesion it is apt to fail of its object. Rapid stretching, unless attended by complete rupture of the stricture, will usually serve only to inflame and irritate the strictured tissue and cause it to become resiliant and elastic. It is, perhaps, a safer operation than internal urethrotomy in the deep urethra; but external perineal section is safer by far than either of these operations in cases of pronounced stricture. There are

however some indications for the use of this instrument, which are well outlined by Keyes as follows:\*

1. "To pass over a whalebone and in cases of very tight strictures so as to dilate them moderately. (a) In the anterior urethra in order that the large shaft of the dilating urethrotome may be made to pass. (b) In the deep urethra in order to make it possible to take up the treatment with sounds in gradual dilatation.

2. "To divulse stricture of the deep urethra in the occasional cases where that operation seems to be called for when the patient refuses external perineal section and the choice lies between divulsion and deep extensive internal urethrotomy.

3. "To pick up and remove small foreign bodies from the urethra."

To the indications above presented I would add, resilient, elastic, and recurrent stricture of large calibre in the deep urethra. In these strictures dilatation is usually carried on until the morbid tissue is very slight in amount and involves but a superficial extent of the urethra and the sublying connective tissue. Under such circumstances urethrotomy may be objected to on account of the danger of haemorrhage, and external perineal section for such slight lesions is certainly a little severe. Divulsion, under these circumstances is a useful operation. Dilating urethrotomy carefully performed is occasionally justifiable in such cases. After the operation of divulsion Keyes recommends leaving a small catheter in the bladder for forty-eight hours. He says: "I have gradually come to the belief that such drainage of the bladder is of assistance in averting urethral fever in cases of divulsion and after deep internal urethrotomy."† The end of the catheter is left

\*Op. cit.

†N. Y. Med. Jour., March 16, 1875.

open to drain into a urinal and the patient is kept in bed for about three days.

The treatment should be continued by gradual dilatation. A steel sound of moderate size is to be introduced four or five days after the operation, the time varying with the amount of inflammation resulting from the rupture of the stricture. An instrument should be passed at first every other day, the intervals being subsequently lengthened.

#### INTERNAL URETHROTOMY.

*Internal Urethrotomy* consists in the division of the stricture by cutting instruments. These are practically of three kinds—viz. (1) those which cut the stricture from before backwards; (2) those which cut from behind forwards; (3) those which, in addition to a cutting blade passed through a hollow central guide, have two separable blades, the object of which is to complete the operation by divulsing or tearing any of the fibres of the stricture which may still remain after the incision. The instruments most frequently used are those of Maisonneuve, Civiale and Otis. Various modifications of the urethrotome have been devised by Van Buren, Gouley, Berkeley Hill, Wyeth and others.

Maisonneuve's instrument cuts from before backwards, and is serviceable for the division of strictures of the deep urethra. It consists of a hollow tube with a slit upon the side which corresponds to the floor of the urethra. Triangular knives of different sizes fastened to a wire shaft are passed along this central tube after its introduction into the bladder, until the stricture is divided. This urethrotome is supplied with a screw tip, to which a filiform bougie may be attached. The principal objection to the use of this instrument is that it never divides the stricture completely unless a very large blade is used, in which event much more cutting

is done than is absolutely necessary, and serious haemorrhage is apt to result.

Civiale's urethrotome has been a very popular one, but with the advent of the Otis instrument and its mod-

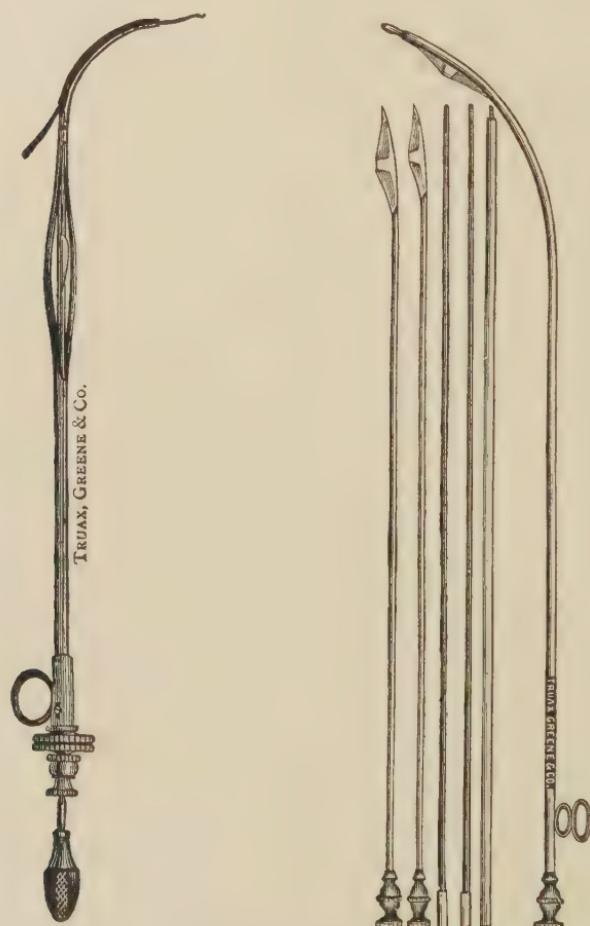


Fig. 61. Gouley's Dilating Urethrotome.

Fig. Fig. Maissonneuve's Urethrotome.

ifications the simpler instrument of Civiale has fallen into disuse. It consists of a small shaft upon the end of which is a bulb with a slit upon one side. This slit contains an oval blade which may be protruded from

the size of the bulb by a sliding wire contained within the hollow shaft. The instrument is passed through the stricture and then withdrawn until the shoulder of the bulb comes in contact with the posterior sur-

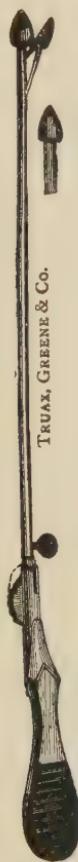


Fig. 63. Civiale's Urethrotome.



Fig. 64. Otis Straight Dilating Urethrotome.

face of the lesion. The blade is then to be protruded by the mechanism upon the handle and fixed in the desired position. The instrument is then withdrawn, the stricture being cut through from behind forwards. It

can only be used conveniently in the pendulous urethra. It has seemed to me to be a bunglesome instrument, and

it is certainly far inferior to the Otis dilating urethrotome. It is preferred by Thompson for operations in the penile urethra, but I must confess that I have never been able to use it with any degree of satisfaction.

Otis' dilating urethrotome is the best instrument that has so far been devised for cutting strictures in the pendulous portion of the urethra. The latest pattern consists of a straight tunneled shaft with a secondary blade, the two being separated by means of a powerful screw. The cutting blade is slipped along in a groove upon the central shaft. Attached to the handle near the screw is a dial plate. By this instrument the urethra may be cut—or dilated and cut—to a calibre of 45 French.

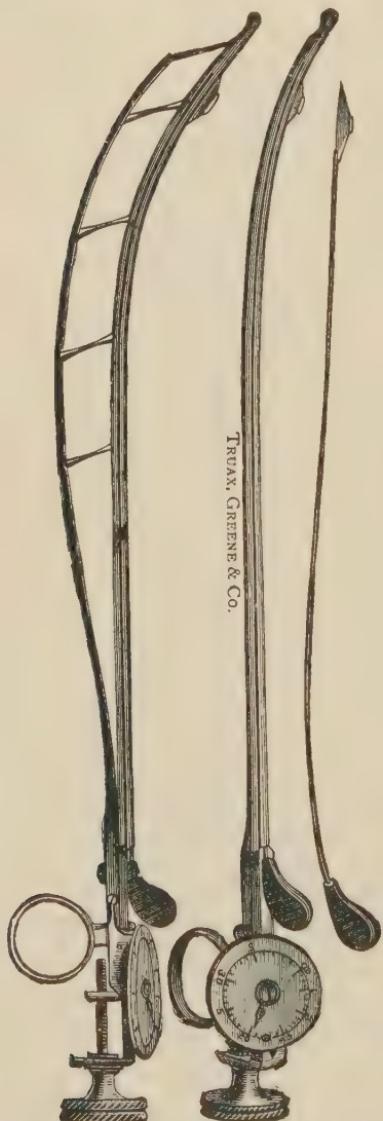


Fig. 65. The Otis Curved Dilating Urethrotome.

patient under full ether anaesthesia. Cocaine is not

The operation of dilating urethrotomy may be performed under cocaine, although it is perhaps better on the average to put the

always reliable, and it must be admitted that it is, so to speak, rather a tricky drug for general use. I do not, however, accept all the fatalities which have occurred under its application to the urethra, as due to the cocaine *per se*. Certainly, even those who do accept all such cases as evidences of the dangers of cocaine in genito-urinary surgery, must admit the existence of some peculiar idiosyncrasy in the fatal cases. Even ether is not above reproach in this respect. Laying aside for the *nonce*, all arguments for and against the drug, it is unquestionably a toxic agent of no mean power, which should be used with more circumspection than seems to be the rule. A two per cent. solution is usually strong enough, and may with advantage be made by dissolving the requisite amount of cocaine in a two per cent. carbolic acid solution, this being supposed to retard absorption of the cocaine and limit its action to a purely local effect.

If an operation is necessary at all an anæsthetic of some kind is certainly warrantable. Under the use of cocaine the patient's apprehensions are not removed as they are by full anæsthesia, and the surgeon is apt to be less thorough in the operation than if satisfied that the patient is entirely unconscious; in some patients of a nervous temperament therefore, full anæsthesia is imperatively necessary. Prior to exploration of the urethra, and again before cutting is begun, the canal should be flushed out with a 1-20,000 bichloride solution.

#### OPERATION.

The number of strictures and the distance from the meatus having been estimated as accurately as possible, the dilating urethrotome is passed down until the point upon the shaft at which the blade will first appear when withdrawn, corresponds with a point in the urethra about half an inch behind the stricture. The

blades are now to be separated by turning the screw until tension of the stricture or strictures is brought about; the cutting blade is then to be steadily and with moderate rapidity withdrawn. The dilating blades are now separated to the required extent. They are then screwed together again and the instrument withdrawn, care being taken not to catch the mucous membrane between the blades during withdrawal. Exploration with a full sized bulbous bougie should now be made to determine whether the strictures have been completely divided. Should the urethra not be perfectly free, the urethrotome should again be inserted and used in the same manner as before. The operation is to be completed by the passage of a full sized steel sound. After the operation the urethra should be irrigated with a hot saturated solution of boric acid or a bichloride of mercury solution, 1-20,000. The patient should be put to bed and an ice-bag or the cold water coil applied to the parts.

The determination of the size to which the urethra should be properly enlarged involves some nicety of judgment. The only fixed standard that has ever been advanced is that of Dr. Otis already described.

It would seem essential at this juncture to repeat the essential points of the Otis method.

According to this authority the average size of the urethra, as determined by numerous measurements with the urethrameter, is as follows: When the circumferential measurement of the penis is three inches the urethra should admit a sound No. 30 French. With each one-eighth of an inch increase in the circumference of the penis the urethra is supposed to increase one-third of a millimeter in diameter, that is, it should admit one size larger upon the French scale. Thus the circumference of the penis being 3 1-8 inches the urethra should take 31. With a circumference of 3 1/4 inches, 32 and

so on. A circumference of  $4\frac{1}{4}$  to  $4\frac{1}{2}$  inches is rarely exceeded. In such cases the urethra should admit at least 40 French. Dr. Keyes' remarks upon this point will, I think, be indorsed by the majority of surgeons. He speaks as follows: "If the surgeon desires to enlarge the patient's stricture as widely as he can in safety, and desires the test as to the limit in size of the sound which he shall use, I know of no better ultimate limit than the scale proposed by Otis, giving it as my personal opinion that while his limit may be safely aspired to and reached, it is wiser to fall short of the standard by a few sizes, in which case all the advantage claimed by Otis will be ordinarily secured, and some of the disadvantages of a urethra unnaturally wide will be avoided.

"That these sizes may be safely attained, the long experience of Dr. Otis proves; that they are generally necessary I personally am not convinced. That they may sometimes be desirable I believe. The limit, however, I consider a little too much for practical adoption, and I prefer in cases that will get well without reaching so large a size to disregard it; in others to scale down a few sizes, believing that as much good may be attained and some possible harm, and often some complaint from the patient averted."

One of the principal objections to Dr. Otis' measurements is that they are liable in many cases to apparently demonstrate the existence of a stricture of large calibre at points of normal relative inelasticity of the canal. There is however, as a rule, no danger and no disagreeable results in all probability, to be apprehended from dilating the urethra after preliminary incision, to as great a calibre as is possible with the Otis instrument. Occasional cases may arise in which damage might be done.

I have found that it is generally practicable, and, as a rule, advantageous to enlarge the urethra as recom-

mended by Dr. Otis where urethrotomy is necessary; but I have not as yet succeeded in convincing myself that the size attained at the time of operation should be maintained by subsequent dilatation with sounds. In fact, it will often be found impracticable to maintain a calibre of more than 32 to 35 French, even where the urethra has been incised and stretched to the fullest capacity attainable by the Otis dilating urethrotome (45 French.) The enlargement of the urethra secured by the operation, even when the cutting is thoroughly done, is to a certain degree temporary in character, being dependent upon overstretching of the muscular fibres of the urethral walls. This overstretching makes the urethra flaccid, and for a few days a large sized sound will be admitted; but after a time the tonicity of the urethra is restored, and as a consequence an instrument of the size which it was practicable to introduce immediately after the operation, can no longer be passed without the exhibition of undue force and the production of considerable pain and spasm. In fact, the permanent calibre of the urethra, which it is practicable to secure by the operation, is usually some sizes smaller than that primarily secured.

In strictures of large calibre, within two and a half inches from the meatus, I have operated successfully through a urethral speculum such as shown in Fig. 58, dividing the stricture with a sharp curved bistoury.

In the performance of urethrotomy the rule should be, (*a*) to make the incision downwards at the meatus and a short distance within it, (*b*) to cut upon the roof of the canal in the penile urethra, (*c*) to cut downward in the balance of the canal, unless the curved Otis dilating urethrotome be used, in which event the direction of the cut should be upward.

#### UNTOWARD EFFECTS OF THE OTIS OPERATION.

There is sometimes considerable inflammation fol-

lowing the operation of dilating urethrotomy. This may give rise to chordee, which may last for some little time, perhaps leaving a curvature which persists for some weeks or even months after the operation wound has entirely healed. Dr. Otis claims that he has never seen a case where the plastic exudation causing such a chordee was not finally absorbed. He says: "Two cases have come to my knowledge where the frequent passage of sounds (daily) was kept up, notwithstanding an acute inflammation was present, and where curvation resulted which gave great annoyance for over a year. One where the introduction of sounds was daily practiced for six weeks with so great pain that ether was required to effect it, and yet this case finally recovered. In the other, operated on a little over a year ago, aggravated in the same way, the curvature still persists.



Fig. 66. Otis' Urethrotome for Diagonal Section of the Urethra.

Such rare cases, evidently due to gross error in after-treatment, cannot legitimately count against the operation when well and judiciously performed. Several cases of persistent curvation of the penis resulting slowly from gonorrhoeal inflammation and consequent stricture have come under my notice, and which have been reduced by the operation of dilating urethrotomy by cross section of the constricting band with an instrument especially devised for this purpose, dividing the stricture diagonally."

I recall a personal case in which permanent and serious curvature resulted. In this case I performed urethrotomy upon two strictures in the penile portion of the canal. Through the patient's carelessness, in-

temperance and sexual indulgence, a second operation became necessary a few months later. Shortly after the second operation the patient contracted a violent urethritis, a permanent chordee resulting. I proposed to perform the operation of diagonal section, recommended by Dr. Otis, but the patient declined further treatment. Fortunately, in this instance the patient was well aware of his own agency in the causation of his deformity. I have seen in several other instances a slight amount of curvature persisting for some little time. I recall but one instance, however, in which a sufficient length of time has elapsed since the operation, to determine whether the condition is apt to prove permanent or not. In this case four years after operation there is still some curvature, but not enough to cause functional trouble. Several cases have passed from under my observation before a sufficient time had elapsed to enable me to base an opinion upon the permanency of the condition. In none of the cases which I have seen, with the exception of the first mentioned, has the deformity appeared to be sufficiently marked to interfere with the function of the organ. I consider, however, that the danger of permanent curvature is to be taken into consideration in spite of the apparently favorable experience of Dr. Otis. Dr. R. W. Taylor admits its occurrence. Neither Taylor nor Otis, however, are sufficiently clear upon this point. I fear that the prevailing tendency on the part of surgeons to withhold the records of their unfavorable cases, has pervaded urethral surgery.

I have observed imperfect erection in several cases which lasted a year or more after urethrotomy. The complaint usually made is, that while the rest of the organ becomes normally erect, the glans remains soft and flabby. This is only explicable on the ground of cicatricial interference with the circulation of the organ.

With regard to the safety of dilating urethrotomy, Dr. Otis speaks as follows: "In my own experience of over 900 operations, not only have I never had a death or a permanent disability of any sort, but I can say today I have never performed the operation either to my own regret or without marked or acknowledged benefit to the person operated on. Prof. Taylor acknowledges *several deaths* from septicæmia following urethrotomy in the penile urethra.\*

Personally, I can only state that I have had thus far, no unfavorable results, yet I am not prepared to believe that the operation is perfectly free from danger.

#### AFTER TREATMENT IN DILATING URETHROTOMY.

I find that the prevailing tendency is to regard the operation of urethrotomy as a trivial matter requiring little attention to details. It is customary for example for the surgeon to operate at his office and allow his patient to go about as much as he pleases. This I hold to be wrong. Where it is possible to do so, the patient should, as a rule, be put to bed for at least a week. As an illustration of the unfairness with which the operation of urethrotomy is sometimes condemned, I will mention a very pertinent case. A prominent practitioner in one of our western cities asked me if I advocated the operation of urethrotomy. On my replying in the affirmative he informed me that he had had bad results with it, the patient dying in one instance. On inquiring I found that the doctor was in the habit of operating at his office, and that in the fatal case the patient rode horseback after the operation, some miles away, to his home and lost so much blood on the way that he died shortly after reaching his destination. It is hardly necessary to state that it was not the operation that killed this patient.

\*Bumstead and Taylor, p. 309.

Personally, while I am occasionally compelled to operate at my office, I am always uneasy regarding the subsequent course of the case.

Cases occasionally occur in which there is little bleeding at the time of the operation, but very free hæmorrhage comes on during the night as a consequence of an erection. This makes the application of cold a prime necessity. In one of my cases a very severe hæmorrhage followed an erection two weeks after operation. In addition to the application of cold I am in the habit of giving anaphrodisiacs after the operation. Ergot, bromide of potassium and gelseminum meet the indications admirably. A suppository of hyoscyamus, morphia and monobromide of camphor has been of great service to me in these cases.

It is my custom to give boric acid in fifteen grain doses three or four times daily after a urethrotomy. This drug keeps the urine bland and aseptic. The benzoate of soda, gaultheria, oil of eucalyptus and salol are also of service.

It is my firm conviction that sounding is usually too vigorously carried on after urethrotomy. I have found that the danger of hæmorrhage, urethritis and curvature of the penis has been directly proportionate to the assiduity with which I have followed up dilatation after the operation. The best results follow infrequent dilatation beginning on the 2d or 3d day after operation—or even later if bleeding be profuse—and repeating the dilatation every 3d day for a week and then every 4th or 5th day thereafter. My conservatism in this respect has been due to observation of dispensary patients who have been negligent after operation, and in whom infrequent dilatation has been perfectly successful. I do not believe that there is much danger in allowing a stricture which has once been thoroughly cut, to go for an entire week without dilatation. The cut ends of the circular

muscular fibres probably retract, and this serves to keep the incision open sufficiently for all practical purposes. The dilatation of the canal by the urinary outflow, also plays an important role in maintaining the patency of the urethra.

*Permanancy of result.* The claims of dilating urethrotomy as advanced by Otis and his adherents have been chiefly based upon the permanency of result which the operation seems to secure upon the average. The only reliable test in any particular case is a re-examination with the bulbs a considerable time after the operation. It is safe to say that in most cases of stricture, appreciable recontraction will occur in a very short time—a few months perhaps—after treatment, if it occur at all. This may be disputed by those surgeons with whom the passage of an ordinary sound is a crucial test for stricture, but it will hardly be disputed by the andrologist who relies upon the bulbs for his explorations. Recurrence is of course not likely to occur if systematic sounding be persisted in at regular intervals, hence old time cases of urethrotomy in which the sound has been used from time to time will not answer our purpose in testing the permanency of the result in dilating urethrotomy. Otis, Mastin, Bevan and many others, have made careful re-examinations of cases operated upon by them at variable periods after operation, and have found the majority of the cases to be still free from stricture. Mastin made re-examinations of eighty cases at periods varying from six months to four years after the operation and found the following: "In fifty-nine cases there was an absolutely perfect result, in twenty-one cases recontraction occurred in one or more strictures, upon twelve of which re-operations were made and subsequently dismissed cured, two had drifted away and six were waiting a favorable time for re-operation." As Mastin tersely remarks, it is not the num-

ber of cases, but the permanency of results that counts for the operation. A large number of cases operated within a few months are not nearly so valuable as a few cases several years after operation.

My personal experience with the Otis method has been extremely satisfactory. The principal source of disquiet has been the frequent occurrence of curvature of the penis already expatiated upon. Regarding this feature of urethrotomy, I have been impressed with the fact that the severity of this symptom varies very greatly under conditions apparently precisely similar. I recall for example, a series of about twenty cases in which this symptom did not occur, and I was congratulating myself upon the pleasant post-operative course of my cases, when a stubborn curvature developed in one of my patients. This case was followed consecutively by seven or eight others with a similarly annoying curvature. Fortunately however, none of these proved permanent.

From an experience of thirteen years with the Otis method I can cordially endorse the claims advanced for its efficacy. I regret exceedingly that my records of operations are marred by the circumstance that in former years I was in the habit of advising the use of the sound many months after operation as a matter of routine. I do not at the present time consider it necessary, as a rule, to pass sounds after the operation wound has healed, for I have acquired great faith in the permanency of my results. Obviously, the cases in which I advised the subsequent use of the sound are of no value in estimating the radical nature of the operation. My experience has comprised nearly four hundred operations up to date, most of which have been upon patients in private practice. I do not include cases in which strictures have been cut at or near the meatus unless deeper strictures have been cut at the same time. Of these cases I have had the opportunity to examine under

suitable circumstances but thirty-five, and in ten of these in which recontraction had occurred, there had been reinfection by gonorrhœa. These latter cases are obviously unfair criteria for judging the results of operation. In several cases recontraction had not occurred in spite of a recurrence of gonorrhœa. I append brief notes of each of the series of cases, omitting those in which recontraction occurred probably as a result of reinfection.

CASE I. Congenital stricture of meatus, two strictures of moderately calibre in the penile urethra. Gleet of seven years standing. Operated upon by dilating urethrotomy in 1881. This case has been under observation at intervals ever since and has had in the interim a fresh attack of gonorrhœa which occurred two years ago. Careful examination with the urethrameter since the attack of gonorrhœa mentioned has failed to detect the slightest recurrence of stricture. This patient had been advised to use the sound from time to time, but had failed to do so through inadvertency. He had been a hard drinker and quite a high liver.

CASE II. Operated in 1880. Gleet of three years standing, following a fourth attack of gonorrhœa (so called). Stricture just within the meatus. Another stricture was detected at a depth of three inches and a half in the penile urethra, with a third slight narrowing in the bulbo-membranous region. Meatotomy and dilating urethrotomy were performed upon the anterior strictures, the posterior being treated subsequently by dilatation. This patient was under observation for some little time on account of his gleet being perpetuated by posterior urethritis which was finally cured. I examined this patient 3 years after the operation, and found that the deep stricture had recontracted, but that the stricture which had been operated upon by dilating

urethrotomy had not returned. In this case also sounds were not passed in the interval between the operation and date of re-examination.

CASE III. Operated in 1881. Moderately contracted meatus and stricture at a distance of two inches and a half from the penile urethra. This patient had a chronic follicular prostatitis with more or less parenchymatus involvement, the organ being moderately enlarged and tender. Frequent and painful micturition was a prominent symptom. After subduing the irritation about the vesical neck I performed dilating urethrotomy. This case was re-examined at the end of a year and found to be perfectly free from stricture.

CASE IV. Obstinate gleet of 18 months duration following a second attack of gonorrhoea. Stricture of medium calibre at an inch and a-half, and a second at four inches in the pendulous urethra. Operation by dilating urethrotomy, meatus not cut. I re-examined this patient at the end of 18 months and again 2 years ago, and found the canal perfectly free.

CASE V. Operated in 1882. Patient presented himself complaining of frequent micturition; had suffered from a gleet until within six months of examination, when it "dried up" spontaneously, after having lasted for six months. He had had two or three attacks of gonorrhoea. On examination a very tight stricture of the meatus was found, and just within the orifice a second stricture which would barely admit No. 5 French. At a depth of four inches in the penile urethra a third stricture was found which was excessively irritable and of quite small calibre. Meatotomy and dilating urethrotomy. Re-examination in 1886—four years after operation—showed no recontraction.

CASE VI. Operated in 1882. Moderately contracted meatus and a tortuous stricture admitting at the first sitting only a No. 7 French, beginning at two inches

from the meatus and extending to a depth of about four and a half inches. Operated by dilating urethrotomy and meatotomy after preliminary dilatation by sounds for several weeks up to a calibre of No. 5 French, a plan which I consider a very excellent one where it is practicable to follow it. This case was re-examined in 1885. There was slight recontraction at four inches and a half, at which point I again operated. This case was seen again in 1887, and there had been no recontraction.

CASE VII. Meatus in this case was quite commodious. There were three strictures at an inch and a half, two and a half and four inches respectively. These strictures were all of quite large calibre with the exception of the anterior one, which admitted only a No. 10 French. Dilating urethrotomy. This case was re-examined in 1884 and was perfectly free. In 1885 it was again re-examined. There was slight contraction of the posterior stricture, the remainder of the canal remained perfectly free.

CASE VIII. Operated in 1882. Gleet of seven years standing, contracted meatus and stricture just within it. Second stricture at a depth of three inches. Meatotomy and dilating urethrotomy. Case re-examined in 1888. There was absolutely no recontraction, although the patient in the meantime had had an attack of gonorrhœa of two months duration.

CASE IX. Operated in 1883. Stricture of large calibre at a depth of an inch and a half, a second which admitted No. 10 French only at a depth of three inches and a half. Dilating urethrotomy. Meatus did not require operation. Case re-examined in 1885 and again in 1887, and found to be perfectly free. Patient meanwhile had been quite a *roue* and had also drunk a great deal.

CASE X. Case operated in 1885. Contracted meatus, strictures of large calibre at a depth of two,

three and three and a half inches, respectively. Meato-otomy and dilating urethrotomy. This case was re-examined in 1888, and again in 1891, and found to be perfectly free from stricture.

CASE XI. Operated in 1884. Stricture at the meatus, another at two and a half inches, and a third at the bulbo-membranous junction. The latter was complicated by fistula and was a hard callous stricture, quite tortuous and involving the urethra from the bulbo-membranous junction well forward toward the penoscrotal angle. Operated by perineal section posteriorly, dilating urethrotomy and meatotomy anteriorly. This case was re-examined in 1885, about one year after the operation. There had been no recontraction of the strictures in the anterior portion of the canal, but the posterior stricture has recontracted to a moderate extent, patient having had no sound passed since leaving my care after the original operation. Sounds were passed upon this patient at the time of this visit, and he disappeared from observation till 1886, when I re-examined him. He in the meantime had not had sounds passed. I found quite a little recontraction of the deep stricture, but found the penile portion of the canal to be absolutely free from contraction. The rather rapid recurrence of the deep stricture was readily explicable on the ground of the dissipated habits of the patient.

CASE XII. Operated in 1886. A single stricture in the penile urethra at a depth of two inches and a half. Meatus sufficiently large. Operation by dilating urethrotomy. Re-examined in 1890 and the urethra found to be absolutely free from recontraction.

CASE XIII. Stricture of the meatus, a second at an inch and a half, and a third at three inches, with an additional deep stricture at the bulbo-membranous junction. As the patient was from out of town and wished a method of operation that would give quick

results, I divulsed the deep stricture, at the same time operating on those in the penile portion of the canal by dilating urethrotomy. The case passed from under my observation, and I did not see it again until a few weeks ago, *i. e.*, early in 1892, when he again consulted me, stating that he had neglected to pass his sound as I had instructed him to do, since about a month after the operation, and that he thought his strictures were coming back upon him. On examination I was pleased to find that although recontraction had occurred in the deep urethra, the strictures in the penile portion had not recurred.

CASE XIV. Operated early in 1888. Contracted meatus and strictures at two inches and three and three-quarters inches respectively. Meatotomy and dilating urethrotomy. Re-examination November, 1891, and found perfectly free from recontraction.

CASE XV. Operated early in 1888. Stricture at meatus, and a second at  $2\frac{1}{2}$  inches, abutting 15 and 20 Fr. respectively. Dilating urethrotomy. Case re-examined in October, 1889, and the urethra found perfectly free throughout.

CASE XVI. Operated in November, 1888. Stricture of the meatus and just within it, and at  $3\frac{1}{4}$  inches. Meatus admitted only No. 10 Fr. The second stricture had a calibre of 20 Fr. In the perineum was a sinus leading down to a hard tortuous stricture of probably traumatic origin. The anterior stricture was due to gonorrhœal infection. Dilating urethrotomy and perineal section. Re-examination in 1890, and although sounds had been passd from time to time, recontraction was found to have occurred in both the anterior and posterior strictures. A second operation was proposed and refused.

CASE XVII. Operated in September, 1888. Meatus sufficiently capacious. Stricture of slight degree at

bulbo-membranous junction, and two strictures of calibre 18 Fr. at 2 and  $3\frac{1}{2}$  inches respectively. Dilating urethrotomy of anterior strictures. Re-examination in 1891, and both strictures were found to have recontracted. Posterior stricture only moderately recontracted. This case was re-operated, but has not since been re-examined.

CASE XVIII. Operated in Spring of 1889. Meatus strictured and three points of narrowing at 2, 3 and  $3\frac{3}{4}$  inches respectively. Dilating urethrotomy and meatotomy. Re-examination eighteen months after operation. No recontraction.

CASE XIX. Operated in Spring of 1889. Very tight stricture of meatus and a stricture of moderately large calibre at 3 inches. Tight stricture at bulbo-membranous region, complicated by a fistula of four years' duration. Perineal section proposed and refused. Meatotomy and dilating urethrotomy performed. Case treated for three months by dilatation; which by the way was not brilliantly successful. The fistula healed within a week after removal of the anterior obstructions. Re-examined January, 1892, patient having meanwhile neglected his case, no sounds having been passed since he stopped treatment with me. No recontraction in anterior portion of canal, and the deeper stricture, although recontracted, was not nearly so much so as I had anticipated.

CASE XX. Operated in November, 1889. Gleet of fifteen years standing. Stricture just within the meatus and a tortuous stricture beginning at a depth of two inches and extending back for a distance of two inches. Meatotomy and dilating urethrotomy. Re-examination in Spring of 1891, and found a slight stricture at bulbo-membranous junction, the balance of the canal being perfectly free. This patient had suffered from a slight urethritis in the interim.

CASE XXI. Operated in December, 1889. Stricture at  $2\frac{1}{2}$  and  $3\frac{1}{4}$ , of a calibre of 20 and 22 Fr. respectively. Slight organic contraction at triangular ligament. Meatus exceptionally large. Dilating urethrotomy and systematic dilation for two months, with urgent advice to have dilation practiced occasionally for an indefinite time. Re-examination in the winter of 1891 showed some recontraction in deep urethra but none in the anterior portion of the canal. Gleet still persists slightly.

CASE XXII. Operated in January, 1890. Gleet of seven years' standing with vesical irritability. Strictures at  $1\frac{1}{2}$  and 3 inches respectively. Meatus amply large. Dilating urethrotomy. Re-examination in January, 1892. The first stricture was found to have recontracted slightly and was again cut. The second stricture remained cured. Gleet still somewhat troublesome.

CASE XXIII. This case presented itself for re-examination within a week. I have no notes of the operation, but recall having cut several penile strictures over four years ago (the patient says that three were cut). On re-examination I failed to find the slightest recontraction. This man was a dissolute dispensary patient, and I confess that I was surprised to find no recurrence of his strictures.

CASE XXIV. Operated early in 1890. Contraction at meatus and at a depth of 4 inches. Meatotomy and dilating urethrotomy. Re-examination December, 1891, showed recontraction, and a second operation was done.

CASE XXV. Operated in January, 1891. Meatus contracted. Stricture just within meatus and a second at  $3\frac{1}{4}$  inches. The latter admitted only a 15 Fr. Meatotomy and dilating urethrotomy. There was quite a persistent curvature of the penis in this case, which

lasted some six months after the operation. Re-examination in April, 1892, showed no recontraction.

Other cases have been re-examined at variable intervals after operation, but the time which has elapsed has been too short to be of any value. It is obvious that the element of coincidence often enters into such observations, especially as influencing the percentage of cures. The entire number operated upon would be necessary to determine this. Even a short list of re-examinations, however, is sufficient testimony as to the radical character of the operation, even though only a few cases have been permanently cured.

The following case, reported by Dr. Stuart Eldridge, of Yokohama, Japan, has a very pertinent bearing upon the prospect of a cure of stricture by urethrotomy:\*

"W. L. Anatire, of England, was admitted to the General Hospital of Yokohama, Japan, December 31, 1874, suffering from syphilitic rheumatism, urethral stricture and urinary fistulæ. February 14, 1875, I joined the staff of the hospital, and found the man an inmate. The history of the case, so far as the stricture was concerned, was as follows:

L. had suffered from stricture, the result of a severe clap, for some eight or nine years, during which time he had led a very dissipated life, and had repeated attacks of gonorrhœa. In the latter part of 1870, or the beginning of 1871, he had been operated upon by external perineal urethrotomy with temporary relief, but had almost entirely neglected the after-treatment of his case, only occasionally and at long intervals passing a very small catheter when retention occurred or seemed imminent. The fistula at present existing was followed by the formation of a second fistula near the root of the penis. The constitutional condition of the patient

\* Vide Otis on Stricture, p. 353.

was such that I attempted no active measures until May, 1875, when the status of the patient was as follows: The urine was passed by the meatus in an intermittent and very small stream of perhaps one millimeter in diameter, by far the greater quantity flowing from two fistulous openings. One, the larger, nearly on the perineal raphe, midway between the scrotum and anus; the other, one centimeter to the left of the peno-scrotal junction. Both fistulæ seemed to diverge from a common sinus, though I was unable to pass an instrument into the urethra through either.

To external manipulation the whole urethra was excessively knotted and indurated, the thickening and hardening being greatest in the proximal half of the penile portion. Examination of the urethra by bulb-sounds revealed a hard and insensitive stricture seven centimeters from the meatus, the contraction being seemingly about three centimeters in length, although, as with the most careful manipulation it would admit nothing larger than a *bougie* of four and one half millimeters circumference, the determination of its proximal limit was uncertain. A false passage was detected, beginning a little more than two centimeters within the meatus, upon the right side of the urethral roof and to a depth of five centimeters, this having probably resulted from rough or drunken attempts at catheterization, and the entanglement of the instrument in the fossa navicularis. The whole urethra anterior to the stricture was rough and nodular, while that portion of the mucous membrane nearest to the face of the contraction was distinctly sacculated at several points. May 18, 1875, after full doses of quinine for forty-eight hours, the patient was etherized, Dr. E. Massais assisting; the meatus, of which the calibre was fifteen millimeters circumference, was freely incised and with great difficulty Holt's instrument, guarded by a Maisonneuve

conductor, was passed through the stricture, until firmly arrested about the bulbo-membranous junction. The instrument was then expanded to the utmost, although, from the fact that its point could not enter the bladder, the separation of that portion of the limbs which was engaged in the stricture was necessarily imperfect. Upon the withdrawal of the dilator its conductor was found to have curled up in the urethra posterior to the just expanded stricture, and examination detected a second stricture of about the same calibre as the first about thirteen centimeters from the meatus, or in the lower bulbous portion. The Holt was then with but little difficulty passed into the bladder and expanded, but only by the use of considerable force, to twenty-four millimeters circumference.

A conical steel bougie, twenty and one-half millimeters circumference, was then passed with ease through the whole length of the urethra. As L. had been unable to feel the sudden yielding caused by rupture, and almost no hemorrhage followed upon this double operation I was inclined to think that dilatation, not divulsion, had taken place, and had I been provided with a satisfactory instrument I should have performed internal urethrotomy at once. No unpleasant symptoms followed the operation and at the expiration of a week I was able to pass a bougie of sixteen millimeters circumference without difficulty, though recontraction to the extent of at least four millimeters of circumference had evidently occurred. The sixteen millimeter bougie was passed six times at intervals of a week, when the fistulae, having healed the patient was furnished with a bougie No. 10 English, and with most careful instructions as to the future use of the instrument, discharged from hospital.

September 6, 1875, L. was re-admitted, suffering as before from syphilitic rheumatism, and evidently

cirrhotic liver, and with both casts pus and albumen in his urine. On inquiry it was found that he had been drinking freely, had suffered from an acute gonorrhœa during the month of August, had entirely neglected the use of the bougie, and that the stricture or strictures had recontracted until the urine at times passed only *guttatim*, and the fistulae in the perineum had partly re-opened. Shortly after admission retention occurred, and after unavailing attempts to pass a catheter by Dr. Massais, I aspirated above the pubes, and a few hours later succeeded in passing a filiform flexible catheter. As about this time the urine began to pass freely by the fistula, catheterization was performed but a few times. Little attention was given the stricture until the following December, when, suffering from excoriation and neuralgic pain, the patient begged for a second operation, to which, with some reluctance, I consented, and determined to perform internal urethrotomy, believing, as I do, that under the circumstances of the case, this operation is little, if at all, more dangerous than repeated, and probably useless attempts at gradual dilatation. The danger of any operation in his condition was fully explained to the patient, but he persisted in demanding relief. Twenty mimims per diem of tr. ferri chloridi were administered for a week, and during the forty-eight hours preceding the operation one hundred grains of quinine were given. December 20, 1875, Dr. A. Goertz of Yokohama assisting, ether was administered, and an examination made showing that the anterior stricture had contracted to a circumference of seven and one-half millimeters, while the bulbar stricture would admit but a filiform whalebone guide. Holt's dilator having been, by the exercise of considerable pressure, passed along the guide into the bladder by means of a tunneled point, was expanded to twenty-seven millimeters circumference. Very

trifling hæmorrhage followed, as had been the case at the first operation. An estimate of the calibre of the urethra about the anterior portion of the bulb, which was the only part of the canal which was approximately healthy, having been made by the use of the urethra meter, the Otis urethrotome was introduced upon a guide, expanded to twenty-nine mm. in circumference, the estimated normal caliber, and both strictures incised from behind forward upon the floor of the urethra. A conical steel sound, 30 mm. in circumference, was then passed into the bladder without difficulty, and 10 grains of quinine administered before the patient left the table. The operation was followed by a sharp attack of urethral fever, with almost total suppression of urine for fourteen hours, but by free administration of quinine, dry cupping over the kidneys and hot water, the condition of the patient was satisfactory by noon of December 22d. A week after the operation a conical steel sound 30 mm. in circumference was easily passed, and afterwards at intervals of a week until it had been used five times in all, not counting the insertion on the day of operation. The fistula rapidly closed, and the neuralgic pain did not recur; but the general condition of the patient became so bad that, as it seemed certain that some improvement in the urethral caliber would outlast the life of the patient, I felt that each use of the instrument, in view of the still diseased condition of the kidneys was attended with danger, and therefore the use of the bougie was given up. July 16, 1877, although the patient was in most wretched condition, he was discharged to the care of his friends for repeated violations of the hospital discipline. He was re-admitted October 18, 1877, in a state that promised speedy death. Contrary to all expectations, however, he lived until June 1, 1878, when he succumbed to syphilitic ulceration of the larynx.

From the time of the operation of December 20, 1875, the patient made no complaint whatever as to the urinary organs. He occasionally amused himself by the passage of a flexible bougie, No. 7 English, but by his own statement there never appeared to be the slightest necessity for so doing. With the exception of the first passages of sounds following the operation, I am certain that nothing larger than No. 7 English entered the urethra from the time of the urethrotomy until after death.

*Post mortem examination*, made June 1, 1878, revealed among other lesions, fatty degeneration of the kidneys and cirrhosis of the liver, while the immediate cause of death was found to be necrosis of the larynx, presumably syphilitic. The penis and bladder were removed intact, save by the displacement of the skin, and on examination the urethra was found to admit, through its whole length, a bougie of twenty-five mm. in circumference.

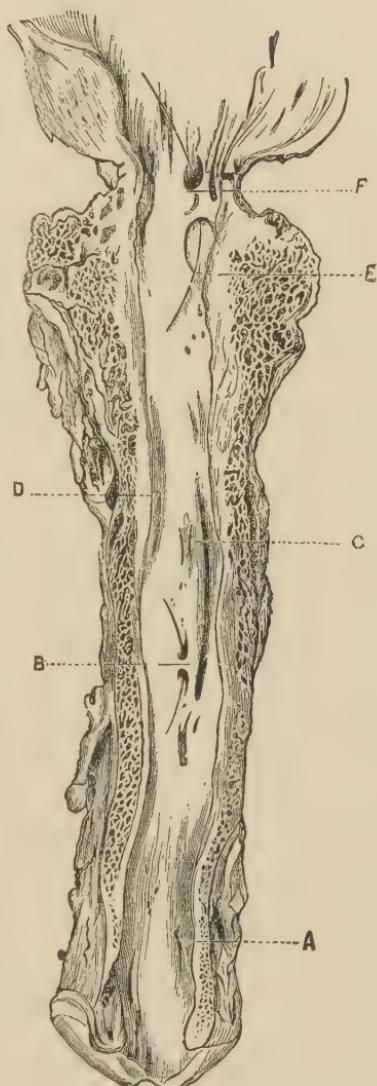


Fig. 67.

Upon examination of the preparation when slit up along the floor of the urethra, there appears a little more than two centimeters from the meatus, and upon the right side of the roof of the canal, a smooth, flexible and elastic, but perhaps cicatricial surface, about eight m. m. in length by four m. m. in breadth, slightly depressed below the level of the general surface. This I take to be the remains of the fossa navicularis, and the closed entrance of the false passage encountered at the operation. (See Fig. 67 at point a.) Six and one-half centimeters from the meatus, and nearly in the median line of the urethral roof, there is a small bridle of soft and elastic covering in a false passage of two mm. in length (*b*). Two centimeters posterior to this, in the median line of the roof of the canal, is a small, irregular, but soft, distensible cicatrix about five mm. in length by two mm. in breadth (*c*) while extending backward from a point on the urethral floor opposite to that just mentioned, is a fine linear cicatrix of about one and a half centimeters in length (*d*). I believe these cicatrices to have been the result—the former of divulsion, the latter of internal urethrotomy. At the bulbo-membranous junction there is an oval depression (*e*) covered with a smooth, elastic, soft membrane, which I take to have been the urethral mouth of the sinus which formerly existed, the more so as a probe passed from behind forward upon this depression, enters a sac of two mm. in depth at the anterior extremity of the surface alluded to. There is also in the membranous portion a false passage of five mm. in length, the bridge of tissue which covers it being soft and yielding.

Most careful examination of the specimen while fresh failed to discover the slightest pathological constriction at any point, while neither thickening nor induration could be detected by most painstaking

search. The points alluded to above as presumably occupied by cicatrical tissue, were only distinguishable as such by their superior smoothness and the apparent absence of glandular structure when examined *in situ* under a low power. At the former location of the bulbar stricture I was entirely unable to identify the scars either of the old external operation or of the later internal incision.

The bridges of tissue constituting the false passages *b* and *f* seemed equally soft and elastic with the rest of the mucous membrane, and certainly did not in the least diminish the urethral caliber. I should say that the evidence as to external perineal urethrotomy having been performed, is solely the statement of the patient, as the asserted locality of the cicatrix of that operation was involved in the opening of the perineal fistulæ. I see, however, no reason to doubt that such an operation had been performed. The case, taken in all its bearings, seems to go far toward proving the permanent curability of urethral stricture, even under the most unfavorable circumstances, providing that a free incision of the contractions is made and they be kept open for a very short time. Considering the facts above stated, a double, tight, cartilaginous stricture, exceedingly resilient, as shown by the failure to divulse, and by its speedy return after large distension, to which was added the traumatic complication of a previous perineal section, the bad general health and habits of the patient, together with the trifling amount of treatment given after the internal urethrotomy of December 20, 1875, it is evident that if, under such circumstances so nearly perfect a result is to be obtained by intelligent urethrotomy, the problem of the permanent cure of stricture may be deemed as solved."

## EXTERNAL URETHROTOMY.

*External Urethrotomy or Perineal Section* may be

divided for description into two varieties of operation, which, although involving the same structures, differ very markedly as regards their prognosis and facility of performance. They are termed perineal section with a guide and perineal section without a guide.

*Perineal section with a guide* is the simpler and safer of these operations, but is adapted only to strictures which are permeable to the passage of instruments. The best procedure is known as Syme's operation of *external urethrotomy*. The instruments necessary for operation are a staff with a central groove, a silver catheter of a caliber of 7 or 8 English, a sharp-pointed scalpel of moderate size, and a strong, broad grooved director. The required size of the guide or staff necessarily varies according to the caliber of the stricture. It may be grooved along its entire length or only along its convexity. Syme's staff has a shoulder which impinges upon the anterior surface of the stricture, the groove in the convexity of the instrument beginning just at this point. If false passages exist in the canal a grooved hollow staff may be used. The successful passage of the instrument into the bladder being indicated by the flow of urine.

*Operation.* The patient, having been anæsthetized, is put in the lithotomy position upon his back with the feet hands fastened together, with lithotomy anklets or ordinary roller bandages, the staff or guide is passed through the stricture into the bladder. The perineum should be scrubbed thoroughly and bathed with bichloride solution  $\frac{1}{1000}$ . The operator, seated in front of the patient, now enters his scalpel with the cutting edge of the blade upwards, into the raphe of the perineum, a  $\frac{1}{2}$  to  $\frac{3}{4}$  of an inch in front of the anus; an upward dissection of about an inch and a half is now made until the urethra is exposed, when the knife is made to enter the groove of the staff behind the stricture,

after which the latter is thoroughly divided from behind forwards. The staff is now withdrawn and a good sized sound passed into the bladder to demonstrate that the canal is perfectly free. A soft catheter or the silver catheter before mentioned should now be passed into the bladder and tied in for twenty-four hours. There are several varieties of drainage tubes which are excellent substitutes for the catheter. At the end of a week or ten days gradual dilation must be commenced, sounds being introduced every second day. The urine escapes by the perineal wound for some little time, but healing gradually occurs and the urine finally flows through its normal channel. Fistula is a rare result; sooner or later the track of the wound closes spontaneously. In very rare instances incurable fistula may result.

The rules for our guidance in the operation as outlined by Syme are essentially as follows:

1. Be positive that the staff or guide has really penetrated the stricture and entered the bladder, this caution being especially necessary if false passages exist.

2. Take care not to deviate the incision from the median line. In this location a sort of septum exists even in the deep perineal tissues. As long as the incision does not deviate from this line there is little or no danger of injuring any vessel of considerable size. The principal vessel which is in danger is the artery of the bulb, but this need not be cut if the incision is carefully made in the raphe.

3. Keep the edge of the knife upwards to avoid opening the posterior layer of the deep fascia of the perineum, with consequent danger of infiltration of urine into the pelvis with serious inflammation, and perhaps gangrene of cellular tissue.

4. Insert the point of the knife posterior to the

stricture and incise it by cutting from before backwards in the groove of the guide.

5. There is sometimes considerable trouble in passing an instrument into the bladder after the stricture has been cut. This may be obviated by inserting a director with a broad groove into the posterior portion of the urethra after the stricture has been divided and before the withdrawal of the staff. The grooved director is turned upwards in such a manner that as the sound or catheter is passed through the canal its point is directed past the incision into the bladder. When the stricture is multiple, the deepest one is generally the narrowest and toughest, and has to be incised, the other and slighter strictures being allowed to remain for treatment by dilatation. When, however, the strictures are very near together, they should be divided by one incision.

In cases in which it is difficult to insert the ordinary grooved staff a filiform bougie may be passed into the bladder and Thompson's dilator threaded upon it. With this instrument the stricture is expanded until it will readily admit the staff. A tunneled staff may however be used, being forced into the bladder over the filiform as a guide.

Reginald Harrison\* has within a few years practiced and indorsed a combination of internal and external urethrotomy. This operation consists of the performance of ordinary urethrotomy, after which a staff with a broad groove is passed into the bladder, and with it as a guide the perineum is punctured to an extent sufficient to permit a large tube to be introduced into the bladder. The object of the latter procedure is to prevent severe urinary fever by facilitating drainage. Prof. Keyes practices this method of perineal puncture in all of his cases of suprapubic section, and

\* Brit. Med. Jour., July 18, 1885.

commends it very highly. He condemns any form of deep internal urethrotomy, excepting the Harrison combined method.

*External urethrotomy or perineal section without a guide*, is one of the most troublesome and formidable operations of surgical practice. Some of the most skillful surgeons who have attempted the operation have failed in its accomplishment. Others have succeeded only after a bunglesome, tedious and prolonged search for the urethra. It is a very fortunate circumstance that such operations are at the present time very rarely necessary of performance, for the reason that if the surgeon be patient and administers an anaesthetic he will be enabled sooner or later to pass an instrument through the stricture and into the bladder beyond it. No matter how small the instrument may be which has been introduced, it constitutes an accurate guide to the course of the urethra if the surgeon is careful in his manipulations. Once an instrument is passed (even if it be but a filiform bougie) into the bladder, the case is practically under control, as a tunneled staff can be threaded over it and pushed through the stricture, the operation being then completed as in the ordinary form of perineal section. The practicability of instrumentation therefore determines the safety of the operation of perineal section. Cases are certainly very rare in which the operation without a guide would be warrantable, for a period of temporizing no matter how prolonged, is better than proceeding at once to such serious measures as section without a guide. Electrolysis may be tried if all other means of penetrating the stricture fail.

In considering the operation of perineal section without a guide we must admit that, although exceedingly rare, cases of practically impermeable stricture may be met with. These may be termed surgically

impermeable. Complete obliteration of the urethra can only be produced by injury, or sloughing of the mucous membrane and corpus spongiosum from some cause. Even in cases in which fistulæ exist with an old and indurated stricture, the urethra is rarely impervious to instruments and urine. It is conceivable, however, that it might become so as a consequence of the diversion of the urine from its normal channel by a fistula, providing some lesion of the mucous membrane had existed which was capable of furnishing inflammatory exudation.

Erichsen records a case which is very interesting as showing that the urethra will remain patent under the most adverse circumstances, as follows:

*Case.* "In the first case in which I performed the perineal section, almost all the urine had for twelve years been discharged through fistulous openings in the perineum and scrotum, and the principal portion escaped through a large hole on the inside of the left thigh, a few drops merely occasionally passing out by the lips of the urethra. No instrument had been passed for four years, though repeated attempts had been made by different surgeons. Being foiled in introducing a catheter into the bladder the first time, I tried on, kept the patient in the hospital two or three weeks attending to his constitutional condition, but without making any further effort. He was then placed under chloroform, when I succeeded in passing No. 1. The urethra was then dilated up to No. 5, beyond which no instrument could be passed, when the perineal section was performed. The patient made an excellent cure, the fistulous openings closing and the urine being discharged by the natural channel."

It is nothing unusual for the surgeon to discover at the time he proceeds to make the perineal section, that anæsthesia will relax the parts, when an instrument of

moderate size may be readily introduced. Whenever, therefore, such operations are determined upon, an attempt should be made to pass instruments after the patient has been anaesthetized, in the hope of either providing a guide for the cutting operation or paving the way to treatment by dilatation, the rule being that when a stricture is permeable to fluid it is not impermeable to a bougie. It must still be acknowledged that there are occasionally exceptions in which the urethra has become so tortuous and contracted, and the tissues of the perineum so indurated by inflammatory deposit—perhaps occurring as a consequence of extravasation of urine—that no instrument can be passed through, although urination can be performed with some facility. In cases of this kind a perineal section without a guide may be necessary.

Operations which are begun without a grooved guide or the insertion of a bougie to indicate the line of the urethra, may often be completed with a guide after the anterior surface of the stricture has been exposed, a filiform bougie being passed through the latter.

*Operation.* There are two ways in which perineal section without a guide may be performed: (1) The urethra is opened in front, and the stricture is divided from before backwards. What is known as the Wheelhouse operation is the best method for this procedure. (2) The urethra is opened posterior to the stricture, and the latter is divided from behind forwards. The first method is by far the preferable one, the classical procedure being the *boutonniere* or a button-hole operation. A sound or catheter of moderate size, say from 8 to 10 English, should be passed down to the face of the stricture. It is then turned around in such a manner that the point of the instrument projects in the perineum in front of the stricture. An incision about

an inch and a half long is now made directly down upon the point of the instrument until the urethra is exposed. A small incision is then made into the latter just in front of the stricture, and the sound hooked up into the upper angle of the wound. A ligature is passed through each side of the incision, and each ligature is given to an assistant. These, in conjunction with the hook-like action of the staff, serve to hold the lips of the wound apart, and to facilitate inspection and exploration of the stricture. A special angular hook-like staff is used by Wheelhouse in this

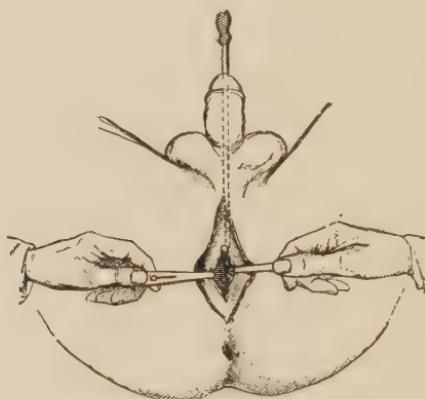


Fig. 68. Wheelhouse's Operation.

Ligatures may with advantage be substituted for the retractors and an ordinary sound will serve quite as well as the special staff shown in the illustration.

maneuver. After the haemorrhage has been checked, the opening through the stricture will usually be readily seen. A fine probe or small director is slipped into this, if possible, and a fine bladed tenotome is passed along the guide so as to divide the strictured tissue. Great pains should be taken to search for the orifice of the stricture, for if a filiform bougie or bristle can be passed through it the operation is greatly simplified, the danger of the operation being that the surgeon will

lose the urethra, and in his aimless efforts to find it severe or even fatal haemorrhage may be produced. I recall a case of this kind in which a very capable surgeon experienced so much haemorrhage in the operation that the patient died within a few hours. In another case I completed an operation after an experienced surgeon had sought for the urethra for two hours and failed to find it.

Should it be impossible to pass a guide through the stricture after its anterior surface has been exposed, the urethra may be opened up posterior to it and an attempt be made to pass a probe or even bougie from behind forwards. Failing in this, a dissection must be made from before backwards in the normal direction of the urethra. Personally, in a case of this kind, I should be inclined to suprapubic section and retrograde catheterism. This procedure has on one occasion been invaluable to me.

After the stricture has been freely divided, a good sized sound should be passed into the bladder to demonstrate that the passage is clear. The sound is then removed, and a catheter passed and tied in as in the operation with a guide. The sound should be passed at proper intervals, as after the ordinary operation of perineal section.

Instead of passing a catheter through the entire length of the urethra and allowing it to remain in the bladder after the operation of perineal section, Harrison's method of perineal drainage is excellent. This consists in the passage of a large soft rubber catheter into the bladder *via* the wound in the perineum. This is tied in and allowed to drain into the urinal. It may be removed in two or three days. Such a drainage tube facilitates washing the bladder and the perineal wound with antiseptic solutions and prevents infection.

Haemorrhage after perineal section may usually be

controlled by pressure. If venous oozing be very free, the wound may be stuffed with styptic cotton. Irrigation with very hot water is often efficacious. When the bleeding is obstinate a petticoated or "shirted" canula may be introduced, as in bleeding after lithotomy. In one case I found the following device to act very well: A stiff gum catheter was passed through an ordinary condom and into the bladder. The condom was then blown up by a small catheter introduced into the outer end, and tied firmly about the catheter left in the bladder so as to prevent the air escaping. By this device sufficient pressure was secured to stop the hæmorrhage. A perineal crutch may become necessary.

One word of caution to the operator may not be untimely. He should begin, if possible, his operation early in the day, and be sure and secure plenty of light. A dark day and a hurry have been fatal to not a few patients in the practice of different surgeons.

#### ELECTROLYSIS.

Inasmuch as the method of treatment of strictures by electrolysis has received enthusiastic support at the hands of surgeons of undoubted skill and ability, it is but just that where possible to obtain the necessary apparatus in cases of stricture which appear to demand immediate operation by external perineal section, an attempt should be made to penetrate the stricture by this method. If cautiously used electrolysis is not apt to do much, if any, injury, and should it fail, it will, in all probability, not enhance the dangers of the perineal operation which will subsequently become necessary. Electrolysis has certainly been of service in my hands in a limited number of cases. Of this more anon.

#### SUBCUTANEOUS DIVISION OF STRICTURE.

This operation has been suggested and practiced

by Dr. C. H. Mastin, of Mobile, Ala., as a revival of an old time and well nigh forgotten operation. In a paper published in 1886, this gentleman spoke of the operation as follows: "In the year 1872 I wrote a paper upon the result of my operations by this method, and since that date to the present, with an increased experience, I have seen no reasons to alter the views which were then expressed. I now claim nothing of originality for the operation, since it is based almost entirely upon the old *la boutonniere*; the incision being very small, and made anterior to the stricture; then, a very small probe-pointed director or whalebone guide is passed along through the stricture, and a delicate tenotome incises its upper wall subcutaneously; the small wound in the integuments is closed by pin sutures and left to heal by primary union. Adhering to the maxim, "dilate where you can, cut where you cannot." I only resort to this operation in those cases where no catheter or guide can be made to traverse the urethra from the meatus to the bladder; cases which require some operation for the immediate evacuation of retained urine, and in which it is not possible for me to perform an internal urethrotomy.

"The patient, duly prepared by opening the bowels freely with an enema and a hot hip bath given to tranquilize the nervous system, is placed upon a table, then secured in the ordinary position for cystotomy and anæsthetized. I now pass down the urethra the tube of Benique, which is a plain silver tube open at both ends, about nine millimeters in diameter, and from six to eight inches in length; this tube protects the walls of the urethra, and puts on the stretch the face of the stricture. The tube is now filled with a bundle of small filiform whalebone probes, which are carefully passed down to the stricture; by trying first one and then another, it is possible that one may engage the opening

and pass on into the stricture. This being accomplished, I remove the disengaged probes together with the tube, and after securing the probe in the bladder I pass over it a Wheelhouse staff which has been drilled through its end to answer the purpose of a Gouley staff, and carry it down to the stricture; it is now handed to the assistant, who holds it lightly, yet firmly, against the coarctation, whilst I open the urethra in the groove of the staff, making an incision about half an inch in length. I then draw outward the staff just sufficiently to enable me to find the whalebone probe as it passes through its end and on into the stricture; this I secure by passing a small blunt hook behind it, after which the staff is removed entirely from the urethra, and the distal end of the probe drawn out through the little wound which has been made; and now, over the probe I pass a little gorgeret; this has its blade directed upward, and being run along the probe, as its guide, it passes through the opening into the urethra, and then down the stricture, which is cut on its superior face. A catheter is now passed along the entire urethra into the bladder and the urine evacuated, after which I carefully examine the site of the stricture with graduated metallic ball probes for the purpose of detecting any bands which, perchance, may remain; if found, they are divided by the retrograde urethrotome of Civiale, and the full caliber of the urethra restored.

"In the event, however, that it is not found possible to pass a whalebone probe in the first instance so as to gain command of the stricture before opening the urethra, I then pass either the staff of Wheelhouse, Gouley, or an ordinary staff of slight curve with deep groove, down to the face of the stricture and practice the Leeds operation, with the exception that I do not rip open the whole stricture; but having gotten the whalebone probe through the coarctation, I thread over

it the little gorgeret and incise it on its superior face, just as described in the instance where the probe was passed along the tube of Benique, always taking care to sever any and all bands which may remain. This opening simply serves the purpose of shortening the canal and bringing us nearer the obstruction; it furnishes us a passage of only some few lines in length in which to manipulate our instrument, in place of a canal of several inches in extent, as would be the case if the urethra had not been opened. I thus virtually performed an internal section; I do not rip open the whole coarctated canal and lay bare to the external wound the cavity of the urethra, but I leave it, so far as the stricture is in question, just in the same condition as an urethra upon which I had done an internal urethrotomy.

"In the absence of the little gorgeret, I have found a very narrow-bladed urethrotome of Maisonneuve, conducted by a small filiform bougie passed through the external opening and coiled within the bladder, to serve a most excellent purpose, provided the staff is grooved on its concavity so as to insure the incision being made upon the roof of the urethra. Such, in brief, is the method I have adopted of operating externally, and find that it is easy of execution, and satisfactory in its results.

"Having carefully divided any existing bands, and restored the lumen of the urethra, I then pass a sound into the urethra, and, after the slight oozing of blood has ceased, I wash the parts thoroughly with cold water, to which may be added either a chlorine or weak mercury solution for the purpose of cleansing and disinfecting the wound; now I close the wound accurately with two or three pin sutures, passed deep enough to engage the divided edges of the urethral canal, and, after coaptating the edges of the skin, I

encircle the pins with a flat thread in the form of the figure of 8; then the sound is removed, and its place occupied by a full-sized catheter passed down to the prostatic urethra, but not into the bladder. The patient is put in bed and kept on his side, with instructions to push the catheter into the bladder when he has a call to urinate, and always, so soon as the urine has been discharged, to withdraw the catheter sufficiently far to get it out of the bladder, but not beyond the stricture. This catheter is used for only twenty-four to thirty-six hours, just long enough to insure the protection of the wound from the passage of the urine until it has been in a measure glazed over, and the strictured portion softened up by the presence of the inlying catheter. On general principles I am opposed to the *sonde à demeure* or retained catheter, and for obvious reasons too patent to need mentioning here; but the sound or catheter, used as I suggest, answers all the purposes for which it is intended, and keeps the urine from the wound until it is sufficiently protected by a glaze which prevents the urine passing into the external incision. At the expiration of this time the catheter is dispensed with and the patient left to pass his urine at will. About the fourth, or at latest, the sixth day, I remove the pins, and do nothing more to the wound save keep up the dressing of lead water and opium—which is applied immediately after the operation—for two or three days longer. Now the patient is permitted to get up and stir about, and within eight or ten days he resumes his former vocations. The after attention is such as is usual in all operations for stricture, whether they be external or internal, viz., the systematic use of gradually increasing steel sounds until the maximum caliber attainable in the special urethra has been reached.

"With this course judiciously pursued, I find that

I am able to discharge my patients perfectly healed within from eight to twelve days; and in not a single instance, out of some twenty-five to thirty operations, have I had to contend with any haemorrhage or the annoying complication of urinary fistulæ.

"The advantages to be derived from this operation are the short time of confinement for the patient, freedom from haemorrhage, quick union by primary adhesion, and the small amount of resultant cicatricial tissue, which is always deposited in greater proportion the longer the healing process continues. The retained catheter for the first day or two does good rather than harm, since it protects the fresh incision from the toxic effects of the urine until it has become glazed over with lymph, and acts, at the onset, by pressure upon the divided stricture, compressing the vessels which have been divided and which might bleed after reaction; it also sustains the urethra as a splint, and prevents the stricture from reuniting until we have time to begin gradual and systematic dilatation with the steel sound. The comparative immunity from urethral fever which my patients have enjoyed after this operation, I feel certain, is due almost entirely to the use of the inlying catheter as I employ it. I do not desire to be understood that I advocate the use of a retained catheter throughout the entire confinement of the patient to bed, but that I use it for only the first twenty-four to thirty-six hours—just sufficiently long to permit the wound to glaze over with lymph, and model, as it were, the granulations by gentle pressure.

"In examining the details of the last ten operations which I have done by this method (all of them bad cases), I find that they were enabled to get out and be around the city in the following order: three on the fourth day after the operation, one on the fifth day, two on the sixth, two on the seventh, one on the

ninth, and one on the twelfth. The others recovered in about the same proportions.

"I am not apprised if any other method of performing external urethrotomy has afforded like rapid results."

I have had no experience with this operation, but it unquestionably has high endorsement in Dr. Mastin and is certainly worthy of more extended trial. Personally, however, I favor free external section and drainage as being freer from the danger of sepsis than the subcutaneous operation.

## CHAPTER XII.

### ELECTROLYSIS OF URETHRAL STRICTURE.

Within the last few years the attention of practical surgeons has been frequently called to the beneficial effects of the galvanic current in producing resolution and absorption of neoplastic and inflammatory formations of various kinds. This process is ordinarily known as *electrolysis*, but properly speaking this term should be reserved for those operations which consist of the decomposition of morbid tissues into their primitive elements by means of the galvanic current. Powerful galvanic currents are accepted as producing more or less complete decomposition of tissue, the oxygen and acids contained in their composition being determined toward the positive pole at the point where it is applied to the surface of the body, the alkalies and hydrogen passing in the opposite direction towards the negative pole, which may be represented by a needle in the case of electrolytic operation upon tumors, and by a metallic insulated bougie introduced into the urethra in the case of stricture. The electrolytic treatment of stricture has been adopted as a routine practice by Dr. Robert Newman, of New York City. This gentleman has claimed some extraordinary results, and has published a series of apparently striking cases in substantiation of his claims of the value of the method. Several other prominent surgeons have tried the method with a greater or less degree of success. The majority of authorities upon genito-urinary surgery, however, have not yet accepted the electrolytic treatment as

preferable or even equal to the measures of treatment that have already been outlined. Prof. Keyes, of New York, has tried the method in a series of cases, and has not been favorably impressed with it.\*

In speaking of the various methods of treatment of stricture, he says: "Time has judged the internal use of caustics and condemned them, while the same fate awaits electrolysis lately revived. My experience with it has been unfortunate."†

The late Dr. David Prince,‡ of Jacksonville, Ill., highly recommended the method.

I have tried the method in a large number of cases, but have not yet become convinced of its value as compared with the methods generally in vogue, and I am satisfied that its efficacy has been greatly overrated. I am free to say, however, that I consider it somewhat illiberal to absolutely condemn electrolysis as a method of treatment for stricture, upon an experience so limited as that of most of those who have radically opposed it, the more especially, as has already been indicated, because the treatment has served me a very useful purpose in a few instances. It is conceivable that in the hands of one so expert as Dr. Newman, much more favorable results might be obtained than by those who are, comparatively speaking, novices in the use of electricity. On the other hand, however, much depends upon Newman's interpretation of the term cure. The enthusiasm of the hobby rider also deserves consideration; the surgeon is too often apt to find only those results for which he is frantically seeking, and fails to see the other side of the case.

The question naturally arises as to the true action of the galvanic current in the treatment of stricture;

\* Practical Electro-Therapeutics; ten cases of Organic Stricture treated by Electrolysis, New York Med. Jour., December, 1871.

† Genito-Urinary Diseases, E. L. Keyes, p. 127.

‡ Essay before Central Illinois District Med. Soc., October 19, 1886.

i. e. is it, strictly speaking, electrolytic? Personally I believe that within the limits of safety electrolysis of stricture cannot be produced, but that a certain amount of stimulation and absorption over and above that which may be produced by the pressure of the electrical bougie *per se* is the true explanation of its action.\* Considerable nicety of judgment is obviously required in the selection of cases, the strength of the current and the frequency of the treatments.

In a lecture before the class of the Medico-Chiurgical College of Philadelphia, Dr. Newman described the method of electrolysis as applied to strictures substantially as follows:† "Electrolysis is the process of decomposing a compound body by electricity, it is a chemical decomposition, and as applied to strictures the action is a *galvanic chemical absorption*. Absorption in this instance consists of the conversion of the morbid tissues into other substances through molecular changes. It will therefore be seen that in the application of electrolysis to the treatment of strictures of the urethra, chemical decomposition and absorption are depended upon. Chemical tissue destruction is in no sense aimed at. Electrolysis may be used in different ways: If the current is weak, slow absorption will be produced; if strong, the absorption will be more rapid, and will destroy the tissues." It is denied that any destruction of tissue is produced in the electrolysis of stricture if properly performed and as Dr. Newman recommends. The patient is first examined, and the location of the stricture determined as under ordinary circumstances with the *bougie a boule*. The various characters of the stricture are determined as far as possible. After having determined the number, caliber, condition and distance of the strictures which exist in the canal, the

\* Dr. Newman disclaims the pressure action of the electrode.

† New England Medical Monthly, August 15, 1887.

next step is to determine the patient's susceptibility to the electric current. A twenty cell galvanic battery is sufficiently powerful for the treatment of stricture. The patient may be placed in either the standing or recumbent posture. The positive pole of the battery should be connected with a large flat sponge, and may be placed in the patient's hands or upon any portion of his body. (It is best in my opinion to place it over the sacrum as in the accompanying illustration.) If the

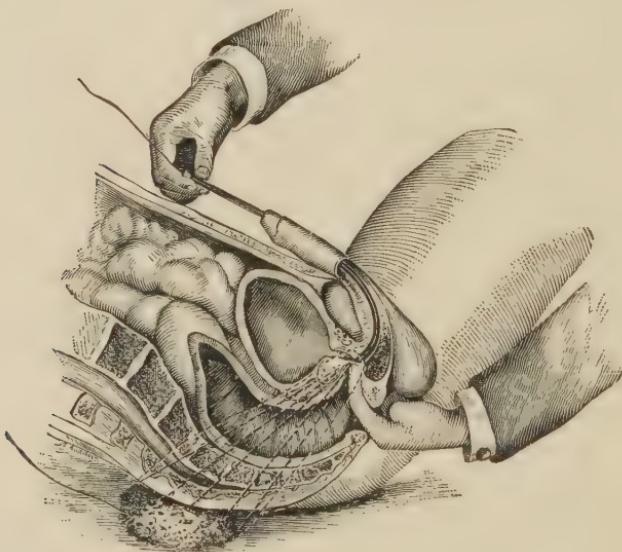


Fig 69. Method of using Electrolysis in Stricture. (*Prince.*)

patient be timid the positive electrode sponge may be fastened to the arm or anywhere else upon the body, or held in the hand. The negative pole is the one which is attached to the bougie electrode and used for the absorption of the stricture. This electrode having been placed at the seat of the stricture after the distance of the first stricture has been measured upon it, the plates of the battery are then immersed in the fluid. It is

better to begin with a weak current, one, three or five cells.

The lubricant which is used for the bougie is an important point. Oil cannot be used for the reason that it is a non-conductor. The best substance is glycerine, as it is a ready conductor and acts almost equally well for the purpose of lubrication.

It is necessary to be certain that the battery is in good condition, as any interference with the chemical action of the fluid or the conduction of the current is fatal to the success of the operation. Irregularity of the current may be produced by a defective condition of the battery or the instruments used, and may not only interfere with the success of the operation, but may produce injury. The methods of determining whether the battery is in condition are (1) testing by the sense of taste. This is done by holding one electrode in the hand and touching the other to the tongue or cheek. If the current is being generated and passing properly a metallic taste will be distinguished. (2) If the electrodes be touched together a spark will demonstrate that the current is passing. (3) A galvanometer or milliamperc-meter may be attached to the battery, the former will demonstrate if the current is passing, the latter will not only demonstrate the passage of the current, but also its strength. (4) The simplest and best method is to immerse the two poles in water, the bubbling of hydrogen gas which appears at the negative pole demonstrates the passage of the current.

The bougie electrode is gently pressed against the anterior surface of the stricture. The sensation imparted to the hand which holds the bougie will demonstrate whether the current is acting satisfactorily or not. The bougie should loosen in the urethra and move slowly onwards under a slight pressure. It usually takes from one to three minutes for a stricture of moderately

large caliber to yield. Each stricture is operated upon in succession until it is felt to give way, great care being taken to use no force in the operation. The electrode is finally felt to pass into the bladder. A succession of bougies of increasing size may be used if necessary. During the entire operation the instrument should be held loosely and gently in its place against the obstruction, violent pressure or force being avoided. The bougie takes care of itself during its work, by the electrical power that its action involves, whereas extreme pressure will only defeat the object and performance of its application, and may produce serious danger from hæmorrhage or even rupture of the urethra. The operation being completed, care should be taken to reduce the battery to O by gradually moving the switch back to the starting point cell by cell, and only one at a time, before the bougie is withdrawn. Anæsthetics are rarely necessary, as the operation is not particularly painful. Newman uses in some instances cocaine, chiefly for its moral effect rather than because of its anæsthetic powers. A simple form of battery is recommended for general use. Newman says upon this point in his lecture:

" You will find at the instrument makers elaborate instruments, but while elaborate instruments look better and finer, you can perform electrolysis with a more simple and cheaper instrument just as well as with these elaborate ones, and these fine instruments cost too much. I advise you then to buy the cheapest good instrument you can for a beginning, and after you have familiarized yourself with its workings you may add to your armamentarium by procuring larger instruments with other attachments as your practice and fancy necessitates. The 20-cell battery with carbon and zinc elements is sufficient for our purpose as well as for many uses in medical electricity. The elements should be

small in order to give more intensity and less quantity, which means that the current must not cauterize the surface, or cut and destroy tissue like the galvano-cautery, but must work, according to the power employed, within a certain radius of the pole in order to bring about decomposition. A steady current is essential, which, on increasing or decreasing the current, will produce no shocks from interruptions. The duration of each seance depends on the work to be done, and the pluck and endurance of the patient. It is not good to tax the patient's endurance too much or to do too much work. An average duration of a seance will last from five to ten minutes. Often two minutes will suffice, while in other cases twenty minutes may be required; but, as a rule, I prefer short seances with weak currents and longer intervals. The interval between seances ought to be at least one week or longer. In former years I even advised intervals of four weeks, and I never regretted this extra precaution.

"Pain should never be inflicted by the use of electrolysis, and it should not be applied when the urethra is in an acute, inflammatory or even in an irritable condition. I told you before to use weak currents, and the question will arise, what do we understand by weak currents. The current should be measured like other therapeutic doses. There are many difficulties to accomplish this, because accurate instruments for such purposes are very expensive, and the exactness suffers by many outside influences which we cannot govern. For medical purposes it is established now to measure the current by an milliampere meter which you see here, and which I have used in my former experiment. An ampere is equivalent to the strength furnished by an electro-motive force of one volt, passing through a resistance equal to one ohm. One ohm is a unit of resistance; one volt is the unit of tension. For

medical purposes we measure by milliamperes, and you see here the division on the dial of the instrument. For our purpose I have advised to use an electric current of  $2\frac{1}{2}$  to 5 milliamperes. This is a weak current, which may be increased according to circumstances. The milliampere meter is sold now for a very low figure, and therefore each beginner should procure the instrument, which in addition to measurement will also be a sure indicator of the workings of the battery. In some of my former reports of cases I have indicated the strength of the current used by six cells, or from four to ten cells. This was done for the purpose of better popular understanding by the non-experts of electricity, and at the same time it did express a certain measure. I had measured and gauged the current of my battery so that each cell in average yielded one-half of one milliampere, hence a current from eight cells would be equivalent of four milliamperes."

The electrodes for the operation are a matter of some importance. The positive electrode should consist of a handle with a large carbon plate covered with sponge, which the patient holds in his hand or upon some other cutaneous surface. Newman prefers to place it in the palm of the patient's hand, and recommends a large carbon so that the current which completes the circuit of the battery at this point may be diffused over a large surface and through a greater external resistance, the effect being pleasanter to the patient than where a smaller electrode is used. The most important instrument is the galvanic bougie. This should be stiff, unyielding, and made of metal, thoroughly insulated by a finely polished layer of hard rubber, except at either end. The upper end of this electrode is to be connected by binding screws to the negative pole of the battery. The urethral extremity has a metallic bulb, usually silver plated, which is placed

against the stricture during the operation. Newman's electrode has a short curve in order that the operator may with certainty guide with his hand the progress of the instrument and adapt it to the curve of the urethra. During the operation the hand of the operator must guide the instrument with certainty and delicacy with a scrupulous avoidance of force. The larger the instrument the less certainly can it be controlled. Straight, short bougies with acorn-shaped bulbs may be used for the pendulous urethra."

It will be observed from the foregoing description of electrolysis as applied to stricture, that, while it is apparently a very simple procedure, there are certain details requiring most careful attention, and upon which the success of the operation depends. Undue force will certainly produce injury, and should the operator in his enthusiasm attempt to hasten matters by increasing the strength of the current an actual charring of the tissues is apt to result with the inevitable enhancement of the strictured condition of the canal. It is probable that much of the prejudice against the operation is due to inattention to the details of its proper performance.

In one of his more recent papers Dr. Newman has formulated the important points of the operation as follows:

1. "Begin the use of electrolysis carefully; do not cauterize, only absorb; in many cases the current of six cells will suffice.
2. Regulate the power and current of electricity according to the susceptibility of the patient.
3. Repeat seances in intervals not too frequent in succession.
4. Do not grease the bougie with substances that are non-conductors, and would insulate.
5. Wet your electrode sponges with hot water;

keep the plates in the battery fluid only during the operation.

6. Never use force with your bougie; never cause haemorrhage.

7. Do not operate while the urethra is in an acute or even sub-acute inflammatory condition, or when it is too painful.

8. Use your battery fluid weak.

9. Never use two bougies in succession with electrolysis during one seance.

10. Practice at first only one method by absorption. "*Weak currents; long intervals.*"

A work on "Linear Electrolysis" by Dr. J. A. Fort was submitted to the Parisian Academy of Medicine a few years ago, in which the author, who has a large private clinic in Paris, chiefly devoted to diseases of the urinary organs, points out the advantages that this new procedure possesses over internal urethrotomy, dilatation and divulsion, which are employed for the cure of the stricture of the urethra. The author's claims are essentially as follows: Electrolysis is an operation absolutely inoffensive, whereas he considers that urethrotomy is a dangerous operation, often giving rise to fatal accidents. The operation with the electrolyzer is performed without previous dilatation, or any other preparatory treatment. It is performed without causing any pain, and in four or five minutes. Even the narrowest strictures may thus be operated upon at once, and the operation is never attended with haemorrhage nor followed by accidents. It requires no further treatment, and the patient may be allowed to follow his occupations without inconvenience. Relapses are extremely rare. This, however, does not accord with the experience of Dr. Lavaux, who also has a large clinic for diseases of the genito-urinary organs. At a subsequent meeting of the Academy of Medicine this

author read a note on the remote results of linear electrolysis in the treatment of urethral stricture. According to his experience, some of the patients were cured for a time only, and more frequently relapses were rapid. Of thirty-five cases operated on with the electrolyzer, the radical and permanent cure claimed by Fort has never been obtained. Dr. Lavaux, therefore, prefers rapid dilatation to all other methods in the treatment of stricture of the urethra.

At a later meeting of the Academy of Medicine, Dr. Dujardin-Beaumetz presented, in the name of M. Fort, a patient affected with stricture of the œsophagus, which M. Fort had operated on, assisted by Dr. Brochin, the well-known surgeon, by his procedure of linear electrolysis. The stricture, which was operated upon the 16th of February, then measured five millimeters in diameter, but when the patient was presented it measured fourteen millimeters. The patient, who arrived from the provinces, and who was dying from inanition, was scarcely able to swallow even a few drops of liquid, but since he submitted to the operation he is able to take all sorts of nourishment. On his arrival in Paris, on the 16th of February, he weighed 114 pounds. This was the first time that linear electrolysis had been applied for the cure of stricture of œsophagus. The success was considered complete.

Regarding the so-called electrolytic method it is not difficult to comprehend how ones judgment may be perverted by the practical and brilliant demonstrations of the power of the electrolytic current. It is all very well to exhibit the manner in which a piece of meat can be destroyed by the galvanic current, but this experiment proves nothing as far as urethral stricture is concerned. Cut out the stricture tissue and expose it to the same current, and it too will be destroyed. To destroy this same tissue in its fortified position in the

urethral walls is a very different matter. The adventitious tissue is mingled with useful tissue, which if destroyed, is replaced by a denser stricture than ever; then too, the adventitious tissue is insulated, so to speak, by mucous membrane which must be preserved if we would not make a bad matter worse. True electrolysis then, within the limits of safety, cannot be brought to bear upon urethral stricture. The galvanic current—or rather its electrolytic power—has no selective action which enables it to separate the chaff from the wheat, *i. e.* to pick out and dissolve pathological formations while sparing the useful tissues.

He would be wise indeed, who could determine the truth regarding the use of electricity in urethral stricture from the reported results which have appeared in medical literature. The changes have been rung by observers of widely different characters and degrees of credibility. The electrolytic monomaniac, the commercial electrician, the intolerant bigot, and the man who recognizes no difference between the galvanic and faradic currents, have all been heard from, with the result that many conscientious surgeons have thrown their bulbs and batteries into the dead-lumber room. It is easy to understand how Newman can claim so much for the electrolysis of stricture; it is not so easy to understand the absolute condemnation of the method by so broad and scientific a man as Keyes.

To claim such extravagant results as does the Newman school is no more absurd than to assert that the method is absolutely valueless. We must recognize the fact that the galvanic current exerts definite physiological effects upon living tissue, healthy or morbid. Knowing these effects, and knowing the conditions present in stricture, no fair-minded man can deny the probability of definite results in practice. The term electrolysis is here, it seems to me, a very

unfortunate one. The method should be termed galvanism.

I do not consider it practicable, within the limits of safety, as already stated, to bring the electrolytic action of the galvanic current to bear upon a urethral stricture, with the possible exception of flaps and bands which are ingrafted upon the stricture *per se*.

We have in organic stricture several factors:

1. The first and most important is a new growth of fibro-connective tissue;

2. Young cells in the process of metamorphosis into fixed connective tissue;

3. More or less œdematosus infiltration;

4. Hyperæmia or congestion;

5. Spasm;

6. Flaps, bands and bridles, due to exudate within the lumen of the canal and binding its folds together. These are often traumatic, and due to clumsy instrumentation. They are sometimes due to follicular atrophy.

Of the conditions named, only the first is essential to stricture. The other factors I will term plus conditions of stricture. These plus conditions are variable in amount and frequency, but may all be present in any given case, and may be either transitory or permanent.

When properly used, the galvanic current stimulates the circulation, stimulates the absorbents, and allays irritation and spasm. In addition we have the mechanical effect of the bulb of the electrode.

To put the case concisely, I will state my belief that galvanism, judiciously used, will often subtract the plus conditions of stricture and facilitate the penetration of otherwise surgically impermeable strictures. Once these conditions are removed, electricity is no longer useful, and we must seek other means of relief. It may thus be seen that if these statements are true,

the range of application of electricity is not wide. I do not believe it is ever curative of organic stricture, nor do I believe it is often of value in the pendulous urethra. Strictures of this portion of the canal are very likely to require urethrotomy; certain it is, to my mind, that electricity will rarely obviate the necessity for the operation. A case of deep stricture occasionally arises where electricity will relieve retention, and so facilitate subsequent dilatation as to be invaluable, but such cases are not frequent. Surgeons may report cases of impermeable stricture in which electricity has succeeded after all else had failed, by the dozen; but there will still be those among us who believe that the man who sees so many impermeable contractions is either a paper surgeon, unworthy of belief, or his reported cases are simply impermeable to him. As I have previously stated, impermeability of stricture upon one end of the bougie sometimes means impermeability of brain upon the other.

One word of caution regarding the claims of some of the conscientious perhaps, but certainly over enthusiastic supporters of electrolysis, may not be out of place, viz.: It is to be remembered that the temporary removal of symptoms, and even the passage of a good sized sound, does not necessarily mean that a stricture has been cured. Let every electrolytic enthusiast use the Otis standard and apply it conscientiously to his reported cures, and it may reveal some very interesting though cold facts.

In thus stating what I believe to be the merits of the "electrolytic," or, more properly speaking, the galvanic treatment of stricture, I have endeavored to present them fairly and without bias.

As an illustration of the occasional value of the galvanic current, I will cite a very interesting case. F. M., a pitcher in a professional ball club, consulted me

for a deep stricture of many years standing. After some difficulty I succeeded in passing a filiform, and finally a No. 1 French bougie. At the end of two weeks I had only succeeded in passing No. 5 French. No improvement in the stream of urine occurred. The stricture, primarily irritable and presenting from the first the plus conditions of congestion and spasm to a marked degree, became so irritable that for the next two weeks I failed to pass any instrument whatever. As the patient was compelled to leave the city, I determined to try galvanism as a parting shot at the obstinate stricture. With a No. 2 bulb and 3 milliamperes of current I succeeded in penetrating the stricture in less than three minutes. The patient immediately passed a stream of urine which, as he expressed it, was "the biggest he had seen for seven years."

I subsequently tried to complete the cure by electricity, and succeeded in passing bulbs a size or two larger, after which the stricture came to a standstill and was absolutely resistant to galvanism. Gradual dilatation was then substituted for galvanism, and the case progressed finely. In this case it seems to me that we have an illustration of the efficacy of galvanism in removing complicating conditions in organic stricture and its impotency as far as the stricture proper is concerned.

It is probable that the majority of surgeons will be loth to depend upon electrolysis for the cure of stricture in lieu of other measures which have proved reliable in their hands, but the operation certainly merits a fair trial and some attention on the part of students and teachers of the subject of genito-urinary surgery. Unfortunately the surgeon will be compelled to experiment for himself before he can judge of the merits of the electrolytic method.

# CHAPTER XIII.

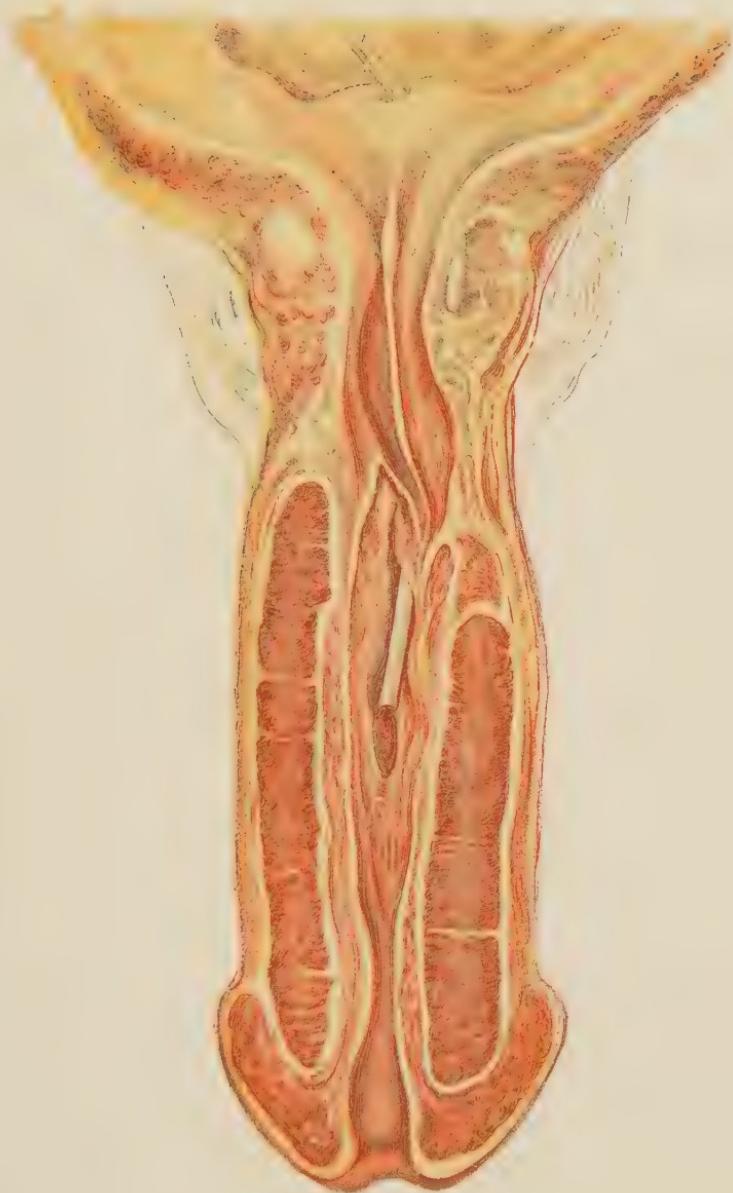
## COMPLICATIONS AND RESULTS OF STRICURE.

FALSE PASSAGES—RETENTION—INFILTRATION OF URINE—  
URINARY ABSCESS—FISTULA—VESICAL CALCULUS—  
ENLARGED PROSTATE—CYSTITIS—PYELITIS  
—EPIDIDYMITIS—IMPOTENCE.

*False Passages* are rare occurrences in the practice of surgeons who exhibit the necessary patience and gentleness in the introduction of instruments. They are rarely caused by the use of large instruments in the ordinary performance of dilatation, and they are certainly very exceptionally produced by the use of other than metallic sounds and catheters.

*Forcible instrumentation* was formerly occasionally practiced for the purpose of relieving retention. A catheter was passed down to the face of the stricture, and then forcibly crowded on in the direction of the bladder. Very rarely indeed did the instrument pass through the stricture. More often it was forced entirely beyond the urethral walls and passed along in the cellular tissue. Once in a while the operator succeeded in reaching and evacuating the bladder. The almost inevitable result of such surgery was the frequent occurrence of false passages. When an instrument is passed in this manner it may enter an enlarged follicle of the urethra and produce rupture at that point. More frequently the instrument enters a pocket in the anterior surface of the stricture, the false passage taking its point of departure at this spot. The

PLATE VI.



Formation of false passage in stricture. The bladder has finally been reached by the instrument, but the urethra has been missed altogether.

(After Dittel.)



signs indicating the occurrence of this accident have already been enumerated. Plate VI shows a graphic representation of the manner of formation of false passages.

*Treatment.* When the surgeon realizes that a false passage has been made, he should practice strict non-interference for a couple of weeks, unless retention exists. Further attempts at instrumentation will only result in all probability in a chronically indurated condition of the false passage. There will at first be slight haemorrhage from the urethra, and within a few days more or less purulent discharge. As a rule the passage will be found to have closed within two or three weeks. It may, however, in spite of conservatism, become chronic. Such accidents as urinary (*i.e.* septic) fever, infiltration of urine, abscess and fistulæ, are occasional results of accidents of this kind.

In passing instruments in a canal in which a false passage is known to exist, great care should be taken to avoid entering the instrument into it. The oftener such a passage is dilated, or even irritated, the longer will it persist, and it may become absolutely incurable if such manipulations be persisted in. The deviation in the direction of the instrument, the sensation imparted to the hand, and the patient's own subjective sensations will usually indicate the position of the instrument in such cases. A careful study of the case is necessary to determine the location of the orifices of old false passages. As a rule, the instrument will engage in the orifice of a false passage much more easily than it will in that of the stricture, and the comparative facility with which the instrument is passed into an abnormal channel may mislead the surgeon, giving him the idea that he is dilating the stricture. A false passage may sometimes be avoided when once its location is determined. It may be necessary, when an

instrument has once been passed into it, to allow it to remain *in situ*, other and finer instruments being passed in the hope of engaging one in the orifice of the stricture proper. The expedient of filling the urethra with filiform bougies is sometimes successful, one or more instruments finally passing the stricture. An excellent plan, and one which has been very useful to me, is to pass an endoscopic tube down to the face of the stricture, a filiform being passed through it and an attempt made to enter the proper channel; if necessary the tube may be filled with the filiforms. When once an instrument is passed through the stricture it should be allowed to remain *in situ*, and the stricture either dilated to a moderate extent by a Thompson dilator slipped along a filiform guide, or the treatment by continuous dilatation begun. If it is found to be impossible to pass instruments through the stricture and retention exists, an aspirator or trocar should be used, while attempts at instrumentation are still persisted in.

The best operation for stricture complicated by false passages is the external perineal section with a guide. Should it be absolutely impossible to introduce a guide, it is necessary to operate without it. Electrolysis may be tried if it be practicable to do so.

#### RETENTION OF URINE.

*Retention of urine* is the most frequent complication occurring in the course of stricture of the urethra. In all cases of stricture of small caliber the patient is constantly menaced with the danger of practically complete closure of the urethra incidental to spasm or congestive and inflammatory infiltration—*i. e.* plus conditions—at the site of the lesion. The danger of the occurrence of this accident is greatly modified by the constitutional condition of the patient, his habits, and what is quite as important, the delicacy of the manipulations which are

instituted for the exploration and cure of the disease. Chilling of the feet and legs, indulgence in alcoholics even to a moderate extent, over-eating and sexual excitement with or without gratification, are the most frequent exciting causes. As an illustration of the manner in which retention is brought about, we will suppose a case of stricture of small caliber. The patient—naturally of an irritable, nervous temperament, and perhaps debilitated—indulges in a prolonged spree in combination with more or less frequent sexual indiscretions. He exposes himself also to cold and wet weather, and moves about more than is good for him. As a consequence of these things, within a few hours he finds that it is impossible for him to pass urine. Spasmodic contraction of the muscles of the deep urethra and of the cut-off muscle in combination with extreme congestion at the site of the stricture, is to be inferred in a case of this kind. On the other hand we will suppose that the patient faithfully follows directions, but unfortunately the surgeon in his anxiety to relieve the stricture, exhibits undue haste and unnecessary roughness of manipulation; in a short time inflammation and spasm at the site of the obstruction occur and retention of urine results. It is very rarely indeed that the progressive, gradual contraction of the stricture produces retention in the absence of some exciting cause such as those mentioned.

When retention of urine becomes complete the bladder soon becomes distended to its utmost capacity, and perhaps yields to the pressure of the contained fluid until it fills a large portion of the abdomen, and as a result of this distension there is considerable pain and constitutional disturbance. Under such circumstances it becomes urgently necessary to speedily evacuate the bladder. If this be not done, overflow may occur after a time, or the urethra will yield posterior to the stric-

ture with consequent extravasation of urine either in front of or behind the triangular ligament. As a consequence of the extravasation, gangrene of the cellular tissue with profound prostration, a typhoid condition and usually death will ensue if the extravasation be extensive, or in more fortunate cases an abscess may form which subsequently discharges and leaves a fistula. In long standing cases in which the bladder is dilated and sacculated, rupture of the bladder itself may possibly occur with an inevitably fatal result. After an attack of retention the bladder is always left in a much worse condition than before, and perhaps may be left in a more or less acutely inflamed state.

*Treatment.* It is well to avoid the passage of instruments at this time where it is possible to do so, as the contact of a catheter with the inflamed structures is apt to enhance the irritation and make a bad matter worse. Antispasmodics should be given and the patient placed in a full hot bath. Morphia may be given by the mouth or hypodermically until the full narcotic effect of the drug is produced. One of the most popular remedies for retention of urine, particularly in stricture of the urethra, is the muriated tincture of iron. This may be given in doses of ten drops every hour or in larger doses less frequently repeated. In the slighter cases of retention this remedy in combination with narcotics, hot baths and other simple auxiliary measures is said to be quite generally efficacious, as indeed it should be by virtue of the auxiliary treatment. As far as the iron alone is concerned, I have failed to note any definite effects from its use. Should these measures fail to relieve retention an attempt should be made to pass a small catheter. Contrary to what might be expected, an instrument sometimes passes through a stricture more easily where retention of urine exists than under other circumstances. This is probably because a slight degree of ab-

sorption of the indurated tissue occurs as a consequence of the inflammation. In addition, it is probable that the pressure behind the obstruction serves to stretch the stricture apart to a slight extent, thus facilitating the entrance of an instrument. If necessary an anæsthetic should be given. Attempts at catheterization are not complete until anæsthesia has been produced. The surgeon should never despair of being able to introduce a catheter until he has failed when the patient is under an anæsthetic. If a catheter cannot be introduced primarily a filiform bougie may possibly be passed. This should be left in the bladder for some little time, and if when it is withdrawn the urine does not flow—as it is very apt to do—a small catheter may usually be introduced. When once an instrument has been passed, the case is under control, and whether catheter or bougie has been introduced the instrument should be tied in the bladder. Leeches should now be applied to the perineum.

Free catharsis by means of salines will usually benefit in a derivative manner. Derivation may also be produced by the hypodermic injection of pilocarpine.

Should it be impossible to relieve the retention *via* the urethra it is wise to temporize by the employment of an aspirator in preference to instituting dangerous operations of a radical character. (Fig. 70). In by far the majority of cases the urine will flow by the natural channel a short time after the distension of the bladder has been relieved by the aspirator. Should this not occur however, the aspirator may be again used, and if necessary a number of times, the surgeon meanwhile proceeding with his antiphlogistic and derivative measures and cautious and gentle attempts to pass an instrument. Should the surgeon be unable to see the patient frequently it might be well after the introduction of a filiform bougie or small catheter to pass a tunneled Thomp-

son's dilator over it as a guide, the stricture being moderately stretched. Divulsion and internal urethrotomy are not to be recommended at this time as a rule. The passage of a catheter for the relief of retention should

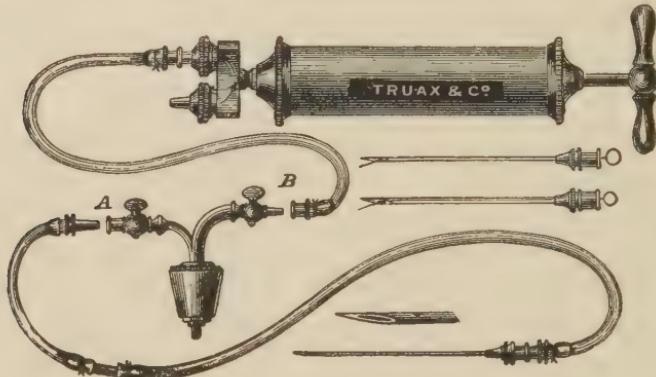


Fig. 70. Potain's Aspirator.

usually be considered as the commencement of treatment by continuous dilatation.

After retention has existed for some little time the urine may begin to flow. This is apt to deceive the surgeon and lead him to believe that the retention has become spontaneously relieved. The apparent relief of the retention, however, is due in most cases to overflow; the bladder having been distended to its utmost capacity, the amount of urine over and above that which the viscus is capable of containing, is forced through the stricture and dribbles away. Palpation and percussion of the abdomen under such circumstances will discover the bladder enormously distended.

If retention be patiently treated in the manner that has been outlined it will rarely be necessary to resort to a radical operation for its relief.

In lieu of aspiration the bladder may be punctured by a curved trocar passed through the rectal walls beyond the border of the prostate. The operation is done as follows: The rectum having been thoroughly cleared by

an enema, the left index finger of the operator is to be passed up beyond the prostate body; the bladder will be felt fluctuating at this point unless the prostate is greatly enlarged—when it cannot be so felt the trocar should not be passed. With the left index finger as a guide, a long curved trocar and canula are passed through the anterior wall of the rectum into the bladder. The puncture made in this fashion perforates the trigone, which is a triangular space at the base of the bladder bounded at its apex by the prostate and at its posterior angles by the orifices of the ureters. The recto-vesical pouch of peritoneum is reflected back above this point and is consequently not in the way of the operation. The seminal vesicles bound this triangular space upon each side and may be wounded if the instrument is deflected from the median line. (Fig. 71).

A circumstance which is peculiarly favorable to rectal puncture is the fact that between the mucous membrane of the bladder and the floor of that viscus, and between the floor of the bladder and the anterior wall of the rectum, there is very little cellular tissue. After the bladder has been punctured the stylet should be withdrawn from the canula and the latter tied in for a few days or until the stricture is under control. The danger of this operation is comparatively slight if it be

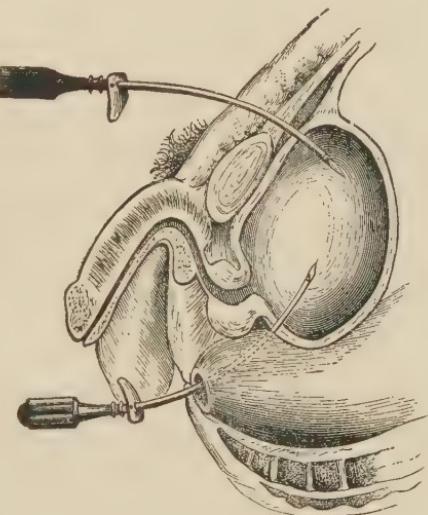


Fig. 71.

Showing proper points for Rectal and Suprapubic Puncture. (*After Erichsen.*)

properly performed; pelvic inflammation and consequent abscess, infiltration of urine, and even peritonitis have nevertheless been known to result. *Peritonitis, however, cannot result excepting in cases of anatomical anomaly in which the recto-vesical peritoneal pouch descends so low as to cover the entire bottom of the bladder as far as the prostate. Instances have been known in which such a pouch has been punctured with a fatal result.*

The bladder may be punctured above the pubes, in cases in which the prostate is so enlarged that the rectal operation cannot be performed, or in case the surgeon has not access to the aspirator or rectal canula. Infiltration of urine into the cellular tissue about this portion of the bladder, with abscess and perhaps a permanent fistula are the principal dangers of the operation. In certain cases of enlarged prostate, whether complicating stricture or not, drainage may be established either per rectum, or better, above the pubes and maintained for a considerable length of time. The point of election whenever puncture of the bladder with the trocar is necessary, is the *trigonum vesicæ*, the only exception being, as already stated, in cases complicated by enlarged prostate. In ordinary cases of enlarged prostate, suprapubic tapping or preferably section is usually the operation of election.

*Forcible catheterization* has been recommended for the relief of retention. It is very unsurgical and very dangerous. Such go-as-you-please operations can only be condemned, as the bladder can only be reached in this manner by the merest accident. Very seldom indeed will the stricture be entered by forcible instrumentation, the catheter reaching the bladder, if at all, through a false passage.

Harrison's operation of opening the urethra behind the stricture may be performed in cases in which frequent attacks of retention have occurred, and the strict-

ure is known to be traumatic, or hard and tortuous. The urethra may be punctured and a tube passed into the bladder for the purpose of drainage, the stricture being left to be attended to subsequently, or the operation may be completed as in the ordinary perineal section—with a guide if possible, without it if necessary. It is advisable however, to await the results of palliative treatment in the hope of getting a guide through after a time, the danger of retention being meantime done away with by the drainage.

Where practicable to do so, it is well to try electrolysis in cases of obstinate retention and impassable stricture, before proceeding to cutting operations.

In surgically impermeable stricture, with retention of urine, the urethra may be opened through the perineum behind the stricture at the apex of the prostate.

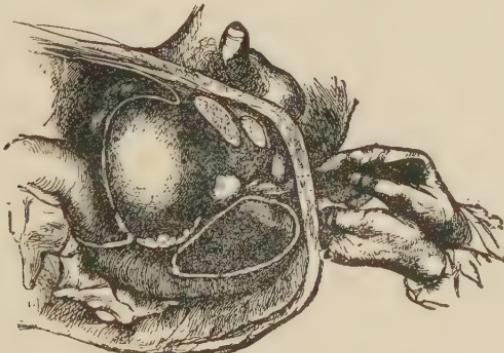


Fig. 72.

Cock's operation of tapping the Bladder via the Perineum and Prostate.  
(After Bryant.)

This operation was devised by Mr. Cock, of Guy's Hospital, London. As described by him, the operation is as follows: The patient being in the lithotomy position, the left forefinger of the operator is introduced into the rectum and the apex of the prostate felt for and carefully thereafter kept in mind. A double-edged scalpel is then plunged with a steady and bold stroke into the raphe of the perineum directly toward the tip

of the forefinger which lies in the rectum, the incision, at the same time, being enlarged in the median line to the desired extent by an upward and downward movement of the scalpel. The wound begins below, at about half an inch from the anus. The finger being still kept in the rectum, after the membranous urethra is opened in front of the prostate, the knife is withdrawn and a probe-pointed director introduced through the wound into the urethra and passed into the bladder. The finger is then withdrawn from the rectum; the director is held in the left hand and a canula, or catheter, is slipped along the groove of the director into the bladder, where it is retained as long as may be necessary.

The interesting feature of this operation is the fact that subsequent to its performance, the previously impermeable stricture sometimes becomes permeable, probably because the rest imposed by the deviation of the urine from the natural outlet, relieves those superimposed conditions the occurrence of which, added to the previous organic contraction, has produced the retention.

The urethra has been opened from the rectum, for the relief of retention, the incision being made into the membranous urethra. A soft instrument is passed into the wound, and from behind forward through the stricture and out at the external meatus, the other end being carried into the bladder. Furneaux Jordan of Birmingham, England, is the sole advocate of this operation, which, to say the least, is of doubtful utility and hardly to be practiced in preference to some of the other operations for the relief of retention.

#### INFILTRATION OF URINE.

*Infiltration of urine* is perhaps the most serious complication of stricture of the urethra. It may occur in any one of five ways:

1. As a consequence of rupture of the urethra or bladder incidental to prolonged retention.
2. By rupture of the dilated and ulcerated point of the urethra behind the point of obstruction, from prolonged and violent straining efforts at micturition.
3. By laceration of the urethra due to the over-distension of the canal produced by the passage of large sounds. In this instance infiltration occurs at the next act of urination.
4. Division, or rupture of the urethra, incidental to the operations of internal urethrotomy or divulsion.
5. Burrowing of urine between the layers of the tissue about the margins of the wound produced by external perineal section.

Infiltration of urine occurs in three forms:

- (*a*) Escape and extravasation of urine into the cellular tissue of the pelvis, as a consequence of rupture of a dilated, thinned and sacculated bladder.
- (*b*) Rupture of the urethra within the confines of the deep layer of the superficial fascia of the perineum or Buck's fascia.
- (*c*) Infiltration produced by rupture behind the triangular ligament, or deep perineal fascia.

*The most common method of extravasation of urine is the giving way of that portion of the urethra which is immediately behind the stricture.* This structure, already thinned and dilated, becomes overdistended and eventually ulceration occurs at some point, usually upon the floor of the canal. As a consequence of retention of urine or of straining efforts in micturition, a few drops of urine escape into the surrounding cellular tissue and an extension of the ulcerative process immediately begins, with perhaps more or less sloughing of the tissues. As a consequence, the trifling aperture in the urethral floor becomes enlarged, and in a short time

the urine escapes in considerable quantity into the cellular tissue of the scrotum, perineum, groin and—if Buck's fascia gives way—the thighs. In some instances the dilated follicle in the urethra becomes acutely inflamed, as a consequence of which its duct becomes occluded. Within the follicle a drop of urine is retained with the products of decomposition and inflammation. After the closure of its duct this little pseudo-cyst becomes distended with pus and the irritating products of urinary decomposition. Under these circumstances it is apt to give way, either into the urethra or externally. Should it give way externally, extravasation of urine may not occur, the process remaining as a folliculitis, or if more extensive, a urethral phlegmon. The abscess may be quite extensive. If the contents of the dilated follicle escape back into the urethra, an opening is thus afforded to the passage of urine. Later on the follicle ruptures as a consequence of over-distension, and abscess occurs. Fistulæ may result from such abscesses. In some instances an abscess ruptures externally and subsequently opens into the urethra. Under such circumstances serious extravasation of urine is not apt to occur, the entire tract of the fistula having become lined with a pseudo-membrane which protects the surrounding tissues from burrowing of the urine. In other instances rupture of the urethra occurs, with the formation of an abscess or sloughing of the tissues; the process finally appears externally, and a fistulous opening into the urethra is thus immediately established. The slower the process of infiltration the more apt it is to be confined by inflammatory exudate, which acts in a conservative manner by preventing serious infiltration.

The slighter forms of infiltration of urine may occur in any portion of the urethra and produce folliculitis, peri-urethral phlegmon, abscess and fistula. When general extravasation of urine occurs, the portion of

the canal that usually gives way is the membranous urethra between the layers of the triangular ligament. At this point the walls of the canal are rather weak, there being a lack of support by the tissues about it. It is at this point also, that dilatation and thinning are most apt to exist, the location of the obstructing stricture being most frequently at the bulbo-membranous junction. Strictures anterior to this point are more often of comparatively large caliber, and are not apt to lead to those conditions which predispose to or excite general extravasation. The infiltrated urine finds its way after a time through the anterior layer of the triangular ligament at the point where it is penetrated by the urethra. It is now beneath the deep layer of the superficial fascia of the perineum, *i. e. within the confines of Buck's fascia*; this fascia, as long as it is intact, subsequently guides the course of the urine. This structure it will be remembered, is attached to the anterior layer of the triangular ligament in the perineum, and laterally to the rami of the ischia and pubes as far upwards as the pubic spine where it becomes continuous with the deep layer of the superficial fascia of the abdomen. This latter fascia in its turn is attached anteriorly along Poupart's ligament as far as the crest of the ilium. The infiltrated fluid, therefore, invariably takes a direction, first, forward into the perineum and scrotum, and second, upwards upon the genitalia and the anterior abdominal wall and outwards along the groin upon either side. Were it not for the limitation of the extravasation by Buck's fascia, the fluid would be governed by the force of gravity, and would pass backwards and downwards, extravasating about the rectum and down the thighs. Should Buck's fascia give way, the infiltrated urine may gravitate backwards, and may also appear laterally upon the thighs. Erichsen records a case in which the fascia

yielded to the pressure, and the urine gravitating backwards gave rise to extensive sloughing in the ischio-rectal fossa and about the nates, denuding the rectum.\*

*The effects of infiltration of urine are two, viz., general and local.* The general symptoms are from the first, in some instances, of an asthenic and irritative character. Even in the strongest patients, infiltration is soon succeeded by a condition of asthenia with typhoid symptoms, low muttering delirium, dry brown tongue, sordes, and finally coma and death. If the treatment is unsuccessful in relieving the infiltration, in some cases in which the infiltration is limited in extent an abscess results with the same symptoms as are observed under ordinary circumstances, with the exception perhaps, that there is a more marked tendency to nervous prostration. The profoundly asthenic character of the constitutional manifestations of general and extensive extravasation of urine is quite remarkable, and can only be explained upon the assumptions that:

1. The parts are very intimately associated with the sympathetic nervous system.
2. There is produced as a consequence of urinary decomposition some peculiar toxic principle allied to ptomaines or leucomaines, which, when absorbed into the blood, profoundly depresses the nervous functions.
3. There is superadded in the majority of cases the absorption of the ordinary products of putrefaction of tissue, *i. e.*, septic infection.
4. There exists a marked tendency to constitutional depression incidental to greater or less marked impairment of the functions of the kidneys and consequent chronic uraemia. •

These four elements in the production of severe, and in a large number of instances, fatal symptoms, should receive due consideration in all cases of the

\*Op. cit. vol. II, p. 877.

kind, as they constitute the most accurate criteria for our guidance in the treatment.

The local effects of infiltration of urine are very marked. It must be remembered that the results of infiltration of urine are not those of contact of the urine *per se*, but contact of urine which has become vitiated by decomposition and the addition of the products of inflammation and putrefaction. Perfectly healthy urine has been shown to be harmless when injected into the cellular tissue. Professor Keyes has discussed the varying effects of healthy and morbid urine when injected into the tissues in a most thorough and scientific manner, and has studied the literature of the subject most exhaustively as will be seen by the following remarks which I have taken the liberty of quoting in full: "It is a property of decomposed ammoniacal urine to destroy the vitality of living tissue wherever it comes in contact with it, unprotected by epithelium. This property does not belong to limpid healthy urine. Menzel\* demonstrated this fact experimentally. He first used acid urine, injecting it under the skin of a dog in quantities varying from a drachm to an ounce without any bad effect in several experiments. He dissected up the skin of a dog to the breadth of four inches, and injected eight ounces of healthy human urine in four different cases. The urine was also absorbed within four days in three of the cases, in the other healthy pus formed. He repeated these experiments in the ischio-rectal fossa without bad results in five cases. To test the opinion of Simon,† that the compression with distension of the tissues in urinous infiltration was the cause of gangrene, Menzel performed two experiments, injecting healthy urine into the tissues with such force as to raise a

\*Wien, medicin. Woch., Nos. 81-85, 1869, and N. Y. Med. Jour., 1871.

†"Chirurgie der Nieren."

tumor of the size of the foetal head, and then prevented the escape of the fluid through the wound by means of suture. The quantity injected amounted to about half a pint, but in both cases it was absorbed without evil result within three days.

"The next experiment consisted in cutting down upon the urethra of a dog and sewing up the wound so as to obtain infiltration. At each angle of the wound a fistula formed, but there was no poisoning or extensive death of tissue. He repeated the same experiment, tying the glans penis so as to cause all the urine to flow into the wound. An immense tumor formed, which only subsided when the glans penis became gangrenous and separated. The dog got well, with simply a fistula. In other similar cases he obtained the same results.

From these experiments Menzel concluded:

1. "That normal urine does not possess septic qualities, and does not produce gangrene by its chemical properties.
2. "That distension by infiltrated urine does not produce gangrene.
3. That gangrene, when it does occur (on infiltration of healthy urine), is caused by contusion or the accidental inoculation of septic matter.

"Menzel next experimented with urine containing soda or potash. Urine so alkalized proved innocuous; but urine rendered alkaline by ammoniacal fermentation he found to be exceedingly poisonous, and when injected, to cause large abscesses and cutaneous gangrene. He also injected putrid urine directly into the blood, and obtained symptoms of blood poisoning. He further adds the clinical experience of Professor Billroth in nine cases of infiltration. In one, the urethra was perforated by a catheter; in three, there was a crushing injury to the perineum; in another, lacera-

tion of the urethra by a splinter of bone from the pelvis; in the rest, rupture of the urethra behind a stricture. Death followed in four cases, in two of which there was stricture, and the urine probably ammoniacal

"A most instructive scientific discussion as to the cause of the fermentation of urine is to be found in the admirable thesis of F. P. Guiard,\* and many new and interesting facts about the toxic qualities of normal urine in Bouchard's admirable contribution to the subject.† Bouchard experimented upon rabbits by injecting normal healthy urine into a vein. An injection of two to three drachms caused contraction of the pupils, shallow, hurried respiration, and finally death with reduction of temperature and of reflex activity. Bouchard believes that in two days and four hours a man eliminates enough poison to destroy himself, were it properly applied. He finds diurnal urine to possess narcotic properties, the night urine to be less poisonous than the diurnal secretion, but to cause cramps and convulsions. He is still investigating this interesting subject.

"But, notwithstanding all this, the fact remains that so far as the local death of tissue is concerned, while ammoniacal and putrid decomposing urine is deadly in its effect, healthy urine, in moderate quantity at least, is readily absorbed by the tissues, and does not lead to local inflammation or death of tissue. My house-surgeon, Dr. Partridge, made for me many experiments by injecting healthy urine, acid and alkaline, (not ammoniacal) into the subcutaneous tissues, using as much as sixty minims at a single injection. No abscess was ever caused by these injections; absorption was perfect. Feltz and Ritter‡ have injected enormous doses of urea into dogs without damage,

\*"La Transformation ammoniacal des Urines," These, Paris, 1883.

†Gazette Hebdomadaire, 1886, Vol. xxxiii, Nos. 13 and 14, pp. 205-221.

‡*La France Médicale*, May 11, 1878.

unless some of the salts of ammonia are combined with the urea. There appears to be no normal ferment in the blood capable of transforming urea into ammoniacal salts. Pasteur\* overthrew Bastian's experiments, and showed that without bacteria urine does not decompose. Pasteur and Joubert,† repeating some of the experiments of Musculus, show that the soluble ferment produced by the latter from ammoniacal urine, which is capable of changing urea and water into carbonate of ammonia, is the product of bacteria. P. Cazenave and Ch. Livon ligated a dog's prepuce, allowed the dog to die, tied the ureters and urethra, removed the bladder, and kept it exposed to air for several days at temperatures varying from 80° to 122° Fahr. The urine did not decompose, and no organisms appeared in it.

"These results, experimental and clinical, correspond with daily experience as well as with my personal experiments undertaken upon the human subject—since the evidence derived from dogs and rabbits has been doubted—to substantiate the fact that healthy urine, injected into the connective tissue without confusion of that tissue, is as capable of absorption as the blandest fluid. This is true, at least, when a small amount is used (5j), a quantity certainly sufficient to establish that healthy urine, *per se*, is not destructive to human tissues. Muron, a pupil of Verneuil, stimulated seemingly by the results obtained by Menzel, performed a series of experiments by injecting urine under the skin of rabbits. His results corresponded closely to those reached by Menzel, only differing in one respect; for, while Menzel states that only urine in alkaline fermentation has destructive powers, Muron proved (upon

\**Comptes rendus de l'Acad. des Sciences*, July 23, 1877.

†*Jour. de Pharmacie et de Chimie*, Sept., 1876, p. 206.

"Dr. L. A. Stimson informs me that, in the winter of 1873, he saw Vulpian, in Paris, inject healthy human urine into the blood-vessels of dogs, in one case three and one-half ounces, without disagreeable result."—*Keyes*

rabbits) that urine, strongly acid, dense and full of salts, urates, etc., has the same powers to a less degree, attributable, he believes, to the density of the fluid injected, which by the law of osmosis attracts serum from the vessels instead of itself being absorbed into the latter; and again to the fact that urine, rich in urates, is apt to decompose quickly. Gosselin and A. Robin\* conclude from experiments that acid normal urine, sp. gr. 1.023, is innocuous when injected into rabbits, although it may kill if continuously injected for a number of days.

"That Muron is incorrect in ascribing *necessarily* destructive properties to dense acid urine, rich in urates, I think must be granted. I obtained a specimen of urine from a child with acute inflammatory rheumatism. It was strongly acid, sp. gr. 1.040, and deposited, on cooling, a dense precipitate of pink urates which equaled one-fourth of the volume of the liquid. A portion of this was taken a few hours after being passed, warmed until the urates dissolved, and injected by Dr. Partridge, of the Charity Hospital, into the subcutaneous tissue of the arm in three patients, half a drachm being used in each case; absorption was immediate and perfect. Twenty-four hours after three other patients were similarly injected from the same specimen, with the same dose ( $\frac{1}{2}$  ss each)—only the urine was injected cold with the urates in precipitation. The bottle was shaken, and the fluid resembled pea soup. A little tenderness on pressure for a few hours marked the spot of the injection, but absorption was prompt and complete in each case without any suppuration.

"Hence it may be affirmed that healthy urine does not, *per se*, kill tissue, unless that tissue be contused or inflamed (absorption thus prevented and urine allowed to decompose *in situ*), and that, with infiltration relieved

\*"L'Urine ammoniacal et la Fievre urinuse," Paris, 1874, p. 39.

by free incision, the prognosis is vastly better if the bladder were previously healthy. After urethrotomy and operations for stone, how rare is infiltration, when the urine is comparatively healthy and has a chance to escape, although it passes over a raw surface on its way out. The practical deduction from the above is to let out urine as soon as it has extravasated, and the chances are that serious gangrene may be averted unless the urine was strongly ammoniacal and decomposed before its escape, which is, unhappily, too often the case."\*

I have on several occasions followed the same line of experimentation with healthy urine as that adopted by Professor Keyes, and have injected fresh urine into the cellular tissue of both man and animals, and have verified his observations as regards their innocuousness.

The lines of analogy which may be drawn between the local and general effects of extravasated morbid urine and the results of inoculation of various animal poisons are very striking. The virus of certain venomous reptiles and insects, the poison of dissecting wounds, erysipelatous poison, the septic products of certain forms of inflammation, the poison of puerperal fever, and that of decomposing urine, are strikingly similar in both their local and constitutional effects. In the first place they are all markedly destructive of the vitality of cellular tissue. It would seem that as soon as any of these poisons come in contact with any of the areolar structures of the body, the vitality of their component cells is speedily depreciated or entirely destroyed, with effects varying from a moderate degree of cellular inflammation to severe and extensive sloughing. There is but little difference to be observed between the local effects of any of these poisons when injected into the cellular tissue. It has been observed

\*Revision of Van Buren and Keyes by E. L. Keyes.

that the poison of the rattlesnake produces a double series of effects. In the first instance it produces local inflammation, suppuration and sloughing, with infection of neighboring lymphatic glands and the production of abscess. These phenomena are precisely identical with the cellulitis produced by the inoculation of septic or erysipelatous poison. It produces in the second instance profound constitutional disturbance. In some cases the poison destroys the life of the individual before the local effects of its inoculation have had time to manifest themselves. In other cases the primary constitutional manifestations are survived and consequently general disturbances come on, their severity and character being determined by the nature of the local changes. The same description may be applied to the effects of any of the other poisons that have been mentioned, their effects varying according to the following circumstances:

1. The amount and virulence of the inoculated poison.

2. The duration of exposure to infection.

3. The inherent resisting power of the individual.

4. His condition at the time of infection.

5. The condition of his eliminative apparatus—this being a vital point, inasmuch as it determines not only the facility with which the system is able to resist the inroads of the poisonous material, but also the rapidity with which it is thrown off by the various emunctories.

It is unnecessary to expatiate further upon this point, sufficient having been already said to call attention to the marked co-relation which exists between the effects of various animal poisons of very diverse origin, and probably also of very different chemical composition. The important relation which bacteria bear to the effects of infiltrated urine is now generally conceded.

When urine is infiltrated into the structures of the

perineum and about the genitals the effect of the irritant poison is immediately manifest wherever the areolar tissue is touched by the fluid. A diffuse cellulitis is set up and the tissues are converted into dark, pultaceous, stringy sloughs, mingled with fetid pus of a dark color, and decomposing ammoniacal urine. If the urethra gives way suddenly, the irritant fluid is forced into the tissues for some distance in and about the affected portion of the canal. Under these circumstances the destruction produced is very extensive. The scrotum may slough, leaving the testes absolutely bare. The patient is apt to die before this occurs, however, so that such an appearance is rare, excepting in individuals of exceptionally powerful constitutions. In some cases the extravasation occurs more slowly, as has been already indicated. A few drops of the irritant fluid escape from the canal through a small solution of continuity in its coats; this gives rise to inflammation of a phlegmonous character in the tissues about the urethra, which limits for a certain time, and perhaps indefinitely, the progression of the extravasated fluid. This inflammation usually causes an abscess which may break internally or externally, and may be followed either by general extravasation or by fistula. When the extravasation is rapid and extensive the perineum becomes brawny, and finally boggy, the scrotum distended and œdematosus, the parts presenting a dusky or purplish red color; the tissues speedily become of a greenish-black hue and lapse into a condition of gangrene.

If the patient is able to resist the depressing effects of the resulting destruction of tissue, either through his inherent resisting power or as a consequence of immediate and successful local and general treatment, repair may be very active. The reparative power of these tissues is something remarkable, and is noted not only in these cases, but in cases of phlegmonous erysipelas

and cellulitis affecting this region. The extravasation rarely extends further than the groins and lower portion of the abdominal wall, but has been known to reach the level of the ribs before the death of the patient. When in the course of retention of urine the urethra gives way between the layers of the triangular ligament, a sense of relief is experienced by the patient, with a feeling as though the tissues had ruptured in the perineum, this being attended perhaps by more or less pain. The symptoms may be obscure for some little time; very little swelling occurs, but in a few hours—or perhaps not for a day or two—a sense of heat, throbbing or lancinating pain and burning will be experienced in the pre-ineum; later on a boggy, diffuse, purplish-red swelling appears in the perineum and scrotum and extends forward very rapidly.

When the infiltration takes place entirely behind the triangular ligament a similar sense of relief is experienced, but the symptoms are subsequently even more obscure. After a time—if the patient lives long enough—deep, throbbing pain will be experienced, and perhaps a swollen condition of the perineum may be detected. Examination per rectum may detect the boggy fluctuation characteristic of infiltration. In those cases of rupture posterior to the ligament the fluid is quite apt to burrow into the pelvis and about the rectum and prostate and destroy life without any positive external manifestations. The patient under such circumstances sinks into a typhoid condition, succeeded by coma and death.

As outlined by Professor Keyes,\* the extravasation may take any one of five directions, which are as follows:

1. "It may when small in quantity get out of the urethra, but not penetrate Buck's fascia, in which case

\*Op. cit. p. 142.

it may long remain confined to one spot in the perineum as a hard, rounded swelling.

2. "It may find its way rapidly through the meshes of the corpus spongiosum and cause gangrene of that body, with sloughing of the glans penis, preceded by coldness and the appearance of a black spot upon the glans.

3. "It may burrow inside of Buck's fascia, but outside of the corpus spongiosum, forming a fistula opening behind the glans penis or on the back of the penis near its root, a hard ridge marking the course of the fistula within Buck's fascia.

4. "It may escape behind the triangular ligament into the cavity of the pelvis.

5. "It may escape outside of the common fascia of the penis, in front of the triangular ligament; in which case it rapidly distends the perineum, the scrotum, and the connective subcutaneous tissue of the penis, and mounts up over the abdomen, and may also, more rarely, perforate the deeper layer of the superficial perineal fascia, and descend upon the thighs.

"When extensive infiltration of this sort occurs, all the parts affected become cedematous; gases form in the connective tissue, causing emphysema, and making the tissues crackle when pressed by the finger. Dark spots soon appear, indicating gangrene, and extensive portions of tissue may slough away unless relief be promptly afforded."

"The constitutional symptoms are those of shock. A chill usually occurs, followed by great depression, a cold, clammy skin, feeble, quick, irregular pulse, hurried respiration, furred tongue, complete anorexia, symptoms of septicæmia and death.

"When the urine escapes behind the triangular ligament, which it does more rarely, it infiltrates deeply around the prostate and rectum well back in the

perineum, around the bladder and up behind the pubis, forming abscess in the cellular tissue of the hypogastrium, or perhaps deep pelvic abscesses."

*Infiltration from rupture of the bladder* is one of the rarest forms of this complication of stricture. Its method of production and effects, although more obscure, are almost precisely identical with infiltration from rupture of the urethra. If the bladder be tolerably healthy, retention of urine will not produce rupture unless traumatism be superadded. For example, a fall or a blow upon the abdomen may produce it under such circumstances. Relief is usually afforded by rupture of that portion of the genito-urinary tract which offers the least resistance—*i. e.* the dilated and diseased portion of the urethra behind the stricture—or by overflow. A certain amount of urine may escape by distension of the diseased portion of the urethra, although the bladder cannot empty itself. In some cases overflow occurs as a consequence of subsidence of the inflammatory and spasmotic elements of the obstruction. By this time, however, the bladder has become so atonied by overdistension that the bladder cannot empty itself. When the bladder is ulcerated, as may be the case when a calculus complicates stricture, or when an instrument has been allowed to remain in contact with the vesical walls for a long period of time, the bladder walls may yield at the weakened point. In cases of extreme dilatation and sacculation of the bladder, the walls of the viscus are apt to yield to the pressure of the contained fluid at the point of least resistance, *i. e.* the thinnest and usually the largest sacci. When rupture of the bladder occurs the contained fluid escapes into the cavity of the peritoneum.

The symptoms of vesical rupture are in some respects the same as those of rupture of the urethra posterior to the triangular ligament. Upon examina-

tion of the abdomen, however, the disappearance of the protuberance produced by the vesical tumor will indicate the character of the accident. In ordinary extravasation from rupture of the urethra the escape of fluid is not sufficient to cause the vesical tumor to perceptibly subside, although it may be enough to relieve the extreme tension of the vesical walls and to make the patient more comfortable. The shock resulting from rupture of the bladder is much more profound than that which occurs from rupture of the urethra, and almost inevitably proves fatal within a very short time. *So much more likely is the urethra to rupture than the bladder, that in spite of the frequency of retention and the marked changes in the bladder wall which are apt to occur in old cases of stricture, rupture of that viscus is one of the rarest of complications.* In the enormous experience of Sir Henry Thompson he states he has never known of the existence of such an accident. The total number of cases reported will not exceed three or four.

The treatment of infiltration must be prompt and energetic. As soon as symptoms indicating rupture of the urethra occur, perineal section and division of the stricture should be at once performed. Harrison's method of vesical drainage should be instituted by the insertion of a large rubber tube into the bladder. Thorough antisepsis by irrigations with very weak solutions of bichloride of mercury should be at once adopted. If diffuse swelling of the tissues of the perineum, scrotum, penis, thighs or groins exists, a free incision should be made at each prominent point.

Whenever lancinating and throbbing pain, with more or less circumscribed swelling are perceptible in the perineum—whether the scrotum be involved or not—perineal section should be made. An examination per rectum will sometimes detect extravasated fluid in cases in which the symptoms are otherwise very obscure.

Under such circumstances the perineal operation should be performed, and a deep incision made in the direction of the peri-rectal infiltration. In making this incision the left index finger should be passed well up into the rectum to protect the gut from injury.

The only hope for the patient in cases of extensive extravasation consists in active surgical interference by free incisions at all points where the infiltrated fluid can possibly be reached. Even if the extravasation and subsequent cellulitis and sloughing be very pronounced, a favorable result may often be secured by this radical measure. It is not sufficient to liberate the fluid that has already escaped, but it is necessary by section of the stricture and perineal drainage by the Harrison method to prevent further extravasation.

Having obtained an outlet for the morbid urine, sloughs and inflammatory material incidental to extravasation, some antiseptic dressing should be applied which will not only tend to maintain the parts in an aseptic condition, but will conserve the vitality of the cellular tissues. The primary shock and secondary constitutional depression incidental to extravasation also constitute a most important indication in the management of the case. Both indications may be fulfilled by the application of hot poultices composed of equal parts of charcoal and linseed meal, sprinkled liberally with brewer's yeast or a hot sublimate solution. All sloughs which may form should be detached as soon as they become loose, and the parts should be irrigated daily to remove discharge as fast as formed. As the sloughs separate, free purulent discharge occurs, constituting a severe drain upon the already depressed system. Liberal support, both dietetic and medicinal, will be required. Milk punch, egg-nog, large quantities of milk and concentrated broths should constitute the diet. A liberal quantity of stimulants, either brandy,

whisky or the heavier wines, should be administered. Should the patient's stomach be irritable, champagne is required. Digitalis, carbonate of ammonia, quinine and tincture of the chloride of iron constitute the only reliable remedies against asthenia in these cases, and should be given in liberal doses.

Rupture of the bladder incidental to stricture demands the same treatment as under other circumstances, but is inevitably fatal.

*Peri-urethral abscess* is intimately associated with extravasation, but the latter may be of comparatively trifling importance *per se*, the collection of pus being relatively of much more serious moment. Abscess about the urethra may arise from several causes: (1) the escape of a drop or two of toxic urine into the cellular tissue as a consequence of solution of continuity of the urethral walls; (2) from the escape of a drop or two of urine into a dilated follicle with consequent free suppuration of the latter. The pseudo cyst finally ruptures and produces abscess about the urethral walls. (3) Irritation and inflammation of the follicles due to the passage of instruments. (4) Puncture or rupture of the urethral walls at some point by the beak of an instrument. (5) Phlegmonous inflammation due to the absorption of organic poison from behind the stricture by the lymphatics; this poisonous material coming in contact with the cellular tissue, sets up suppurative inflammation.

Peri-urethral abscess bears a distinct relation to peri-urethral phlegmon and folliculitis. When decomposing urine escapes into the peri-urethral areolar tissue it sets up inflammation which induces a plastic exudate; in some instances the exudative material closes the orifice through which the urine escapes and prevents further extravasation, thus circumscribing the abscess. Abscesses of this kind may occur at any por-

PLATE VII.



Case showing the results of peri-urethral suppuration with resulting pocket and sinus formation in an old stricture involving nearly the entire extent of the urethra.  
*(After Dittel.)*



tion of the urethra, but are generally seen in the peri-neal part of the canal, on account of its frequent association with stricture at the bulbo-membranous junction. It may subsequently lead to extravasation, because of its opening into the urethra, thus permitting the escape of the urine into its cavity, the walls of which subsequently yield, or it may burrow to the surface externally and heal without difficulty. Again, it may open internally and burrow externally without extensive extravasation, the track of the pus being limited by plastic deposit. Under these circumstances fistula results. These abscesses are rarely dangerous *per se*, their importance being chiefly due to the danger of general extravasation and of the formation of urinary fistulæ.

Erichsen\* states that "the extent and the amount of mischief done by urinary abscess will greatly depend on the side of the urethra on which it is situated. When, as usually happens, it forms at the lower surface of the canal it readily comes forward without much or extensive burrowing; but when situated on the upper wall of the urethra (which, however, is very rare), or at the upper part of the side of the canal, it may burrow widely before it points or is discharged externally, occasioning great induration, infiltration, and mischief in neighboring parts."

The symptoms of *peri-urethral abscess* consist of the appearance of a small, circumscribed, tender, painful and hard tumor somewhere in the course of the urethra. There is usually little or no constitutional reaction. Sometimes however, in extensive abscesses more or less fever is noticeable. When located in the peri-neum this part may become tense, hard and brawny, considerable weight and lancinating pain being complained of. Abscesses of this character are very slow

\*Op. cit., Vol. ii, p. 879

in coming to the surface because of the comparative density of Buck's fascia which binds them down. If the pus escapes from its environment of plastic exudate, it is most apt to follow the same course that is taken by infiltrated urine, there being less resistance to burrowing within the limits of Buck's fascia than to its escape externally.

*The treatment of peri-urethral and perineal abscess,* consists of free incision with antiseptic precautions. It is bad practice to wait for fluctuation, unless the penile portion of the canal be affected, in which case nothing is warrantable but a small puncture to relieve the distention of the abscess and to prevent rupture into the urethra. Even in these cases however, if puncture demonstrates the presence of pus, the abscess cavity should be laid freely open. In perineal abscess a free incision should be made into the induration in the median line. Delay in these cases may lead to extravasation of urine. The after-treatment should consist in the ordinary surgical measures for the treatment of abscess in any situation.

#### URETHRAL FISTULÆ.

*Urethral Fistulæ* result from extravasation of urine and abscess. They are usually located in the perineum and scrotum, but have been noted in the groin, the inner aspect of the thigh, and upon the anterior abdominal wall as a consequence of extensive burrowing of pus. Their point of departure is generally in the vicinity of the bulbo-membranous junction; exceptionally they are met with in the scrotum and about the pendulous urethra. When they occur in the perineum they are often multiple, several openings being found about the perineum, nates, scrotum, and perhaps the inner aspect of the thighs. In a case reported by Civiale, over 50 external openings were

found in communication with the perineal portion of the urethra. There is something remarkable in the manner in which the pus will creep about and form secondary fistulæ in these cases.

The number, location, size, and length of fistulæ are cardinal points in deciding their importance. *Small perineal fistulæ with a single or perhaps two openings are not of very great importance as they will close spontaneously in most cases as soon as all obstructions in the urethra have been removed.* A very interesting case in illustration of this point recently came under my observation.

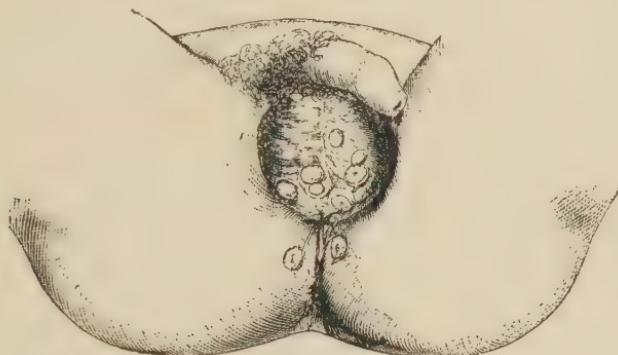


Fig. 73.  
Extensive Fistulæ from deep stricture of long standing.  
(After Bryant.)

A young man had suffered from organic stricture of the deep urethra for six or seven years; this had been followed by perineal abscess and a fistula with two openings. Instruments had been introduced from time to time, so that the stricture had not closed sufficiently to produce retention. The fistulæ would heal from time to time and perhaps remain closed for several months, when a collection of pus would form and they would again re-open. On examination the perineum was found to be hard and indurated, the tracks of the fistulæ involving quite an area of the surrounding tissue. I found that the meatus was so small that it

would admit only 12 French. This was surprising, inasmuch as the patient had been in the hands of several eminent surgeons from time to time, but it seems that they had contented themselves with merely passing small soft instruments. The fistulæ had been open for several months when I first saw the patient. I incised the meatus, and they closed within three or four days and have never since re-opened. The stricture was found to be very hard, tortuous, indurated and resilient. Perineal section was proposed, but rejected by the patient, who was contented with palliation by the occasional introduction of a bougie, although at no time could an instrument larger than 22 French be introduced. Steel instruments could not be introduced at all.

The size of fistulæ depends entirely upon whether or not a loss of substance has occurred and upon the extent of the destruction. They may be large enough to admit several fingers. They are generally tortuous, narrow, and extend for a considerable distance. The external orifice may be very narrow and may heal from time to time as in the case just related. Under such circumstances the urine remains in the track of the fistula, decomposes, and again produces suppuration with external discharge. In some instances burrowing in other directions occurs with the result of producing tributary fistulæ running in various directions. The tissues of the scrotum, penis and perineum in cases of multiple fistulæ, become extremely hard and thickened, having a feel to the fingers almost like cartilage. Where the stricture is very tight and the fistula comparatively large the urine may not pass through the normal channel at all, entirely escaping via the fistula. Rarely indeed, does the stricture become completely agglutinated, although such an accident may possibly occur in cases of traumatic stricture.

*The treatment of fistulae* depends upon their location, number, and the question of the loss of substance. The first principle in their management consists in the removal of all obstructions to the outflow of urine. A dilated meatus and strictures in the penile portion of the canal require incision as under ordinary circumstances. Care should be taken to completely restore the calibre of the urethra, for the more perfectly this is done the less resistance there is to the outflow of urine. By this procedure we take advantage of the physical principle that fluid tends to flow in the direction of the least resistance. Should there be at any point in the course of the canal, sufficient obstruction to produce distension of the urethra behind it, the backward and outward pressure will necessarily force a portion of the urine into the internal orifice of the fistula and thus prevent healing. *The majority of simple perineal fistulae will be found to close spontaneously as soon as the normal calibre of the urethra has been restored.* The tissues in this situation are thick, and reparative action is consequently much more active than is the case in the penile portion of the canal. Then too, the parts are not disturbed by erections, which, by depriving the affected tissues of rest necessarily interfere with granulation and retard the process of healing.

Should simple fistulae show a disposition to become chronic in any portion of the canal, the patient should be instructed in the use of the catheter and directed to draw his urine at regular intervals, thus obviating the possibility of the passage of the fluid through the fistula. Should such measures however, tend to set up irritation of the urethra and bladder, it will be necessary to discontinue them.

The process of repair may often be stimulated by cauterization of the track of the fistula. A good plan is to enlarge the external orifice of the fistula and pare its

edges, its track may then be cauterized by passing a fine platinum wire attached to a galvano-cautery apparatus. This is passed into the fistula when cool and then heated to a white heat and rapidly withdrawn. A fine probe, coated with a bead of sulphate of copper or nitrate of silver, may be used for the purpose of cauterization instead of the galvano-cautery. After the operation a soft, moderate sized catheter should be left in the bladder to prevent any escape of the urine through the fistula. A catheter should be allowed to remain in the bladder for a couple of days. The viscus should be irrigated with a warm mild antiseptic solution, at least once daily. Applications of the tincture of iodine upon a cotton wrapped probe are sometimes effectual in promoting healing.

If the stricture be hard, resilient, or irritable, the best plan is to perform perineal section. All branching fistulæ which can be gotten at had best be laid open and left to granulate from the bottom at the same operation. After a perineal section in stricture complicated by fistulæ the Harrison method of drainage should be adopted. This not only drains the bladder, but prevents the urine—which is invariably of an irritating character,—from coming in contact with the fistulæ. Fistulæ located in the scrotum often require free incision after the removal of urethral obstructions. Such fistulæ will often be found to be connected with unhealthy, sloughy abscess cavities. These should be laid freely open and made to granulate from the bottom.

Siphon drainage has been recommended for simple fistulæ in the perineum. This method consists of tying a moderate sized soft catheter in the bladder. This is attached to a rubber tube of considerable length, which passes into a receptacle containing carbolized water. Four cases are reported by Chiene\* which were cured in this manner.

\*Transactions of the Edinburgh Medico-Chirurgical Society, 1880.

The importance of rest in treatment of urinary fistulæ cannot be overrated. I remember a case of perineal fistulæ which entered the New York Charity Hospital some years ago, that had lasted for some little time after the calibre of the urethra had been restored, and which healed spontaneously after four weeks' rest in bed.

Urinary fistulæ occasionally open into the rectum, in which event we have superadded to the obstacle to healing afforded by the contact of the urine, an additional element, viz.: the escape of fecal matter and gases. These latter materials are likely to pass not only into the fistula, but entirely through it into the urethra. Fistulæ of this sort are not apt to heal even after the urethra has been restored to its normal calibre. The ordinary operation for rectal fistula should be performed in such cases, the rectum and the greater portion of the track of the urinary fistula being laid into one cavity and made to granulate from the bottom. The rectal extremity of the fistula having healed, there may still be an opening in the perineum, the urine alone being sufficient to keep the urethral extremity of the fistula from healing. The perineal fistula may now be treated as under ordinary circumstances.

Thompson<sup>1</sup> records an instance of successful treatment of recto-urethral fistula by position, the patient being instructed to pass urine only in the prone position.

Large fistulæ due to a greater or less destruction of the tissues by which they are surrounded require, as a rule, special measures of operative treatment. The same may be said of fistulæ which fail to heal under the measures of treatment already outlined. Fistulæ in the penile portion of the canal, whether there be any loss of substance or not, are apt to be intractable to treat-

\* Diseases of Urinary Organs, p. 146.

ment. This intractability is due to the extreme tenuity of the tissues, which is unfavorable to plastic exudate and repair, and to the variable position of the organ incidental to erection and the performance of the sexual function, which prevents the necessary rest. Even with considerable loss of substance in the perineum, fistulæ in this region will often close spontaneously, granulation and repair being very active and the parts being relatively infrequently disturbed. Loss of substance may occur in cases of fistulæ due to gangrene and sloughing, extensive abscess, phagedena, or the prolonged contact of instruments with the canal. Necessarily they are most often noted in severe cases of stricture.

*Urethroplasty* is usually necessary in large fistulæ of the penile urethra.

Astley Cooper,\* however, reported a case in which the application of nitric acid was successful in closing a fistula as large as a good sized pea after two successive plastic operations had failed.

Dieffenbach has suggested the application of a strong tincture of cantharides, which destroys the epithelium and stimulates the formation of granulations.

*Perineal fistulae* may often be closed by a comparatively simple operation. The edges should be liberally pared and brought together with the quilled or shotted suture. I have succeeded in curing several of them by repeated suturing after preliminary cauterization.

*Scrotal fistulae* require free paring of their edges. The tissues about the fistula should be extensively dissected up to secure thick, good sized flaps of skin and areolar tissue. These should be stitched together by silver wire or by the quilled or shotted suture. Several operations may be necessary before the cure is complete, each operation making the fistula smaller. The

\*Surgical Essays, London, 1819, p. 205.

urine must be drawn in all instances by the catheter. If the urethra be tolerant of the instrument a moderate soft sized catheter may be left in the bladder for several days. Irrigation of the bladder is necessary to maintain it as far as possible in an aseptic condition, so that in case urine comes in contact with the wound it may not prevent healing.

As a substitute for plastic operations Dieffenbach proposed a much simpler operation. A concentrated tincture of cantharides is applied to the edges of the opening and tract of the fistula. As soon as the epithelium has become detached and the surfaces are sufficiently raw a good sized soft bougie is introduced into the canal; a needle armed with a strong, well waxed silk thread is now introduced about a quarter of an inch from the edge of the fistulous opening. This is passed into the tissue of the corpus spongiosum for a short distance, and then made to emerge. It is re-introduced at the point of emergence, passed along and brought out again in the same manner and at the same distance from the edge of the fistula. This is repeated until the ligature completely encircles the fistula and terminates at the first point of introduction. The thread bears the same relation to the fistula that a draw string does to the mouth of a bag. The two ends of the ligature being drawn together, the freshened surfaces of the fistula are closely approximated. A knot is now tied and allowed to sink into the point of puncture. The urine is to be drawn at regular intervals by means of a catheter. The ligature is allowed to remain for three or four days, then cut and withdrawn. Several operations may be necessary before the fistula is completely obliterated. The operation is only applicable to fistulæ of small size.

In the penile portion of the canal it is quite difficult to perform a successful operation of urethroplasty.

This is due to the thinness and looseness of the integument, and to the sparsity of cellular tissue in this part. So scanty are the tissues that the surgeon naturally hesitates to pare the surfaces of the fistula sufficiently to obtain the desired result. Obviously, flaps with thick edges, such as can be secured in the perineum, heal much more readily than the thin ones which it is practicable to secure in the penile portion of the canal. Erections frequently occur and constitute another obstacle to success, as they produce tension and absolutely prevent the necessary rest.

Several special operations of urethroplasty have been devised. One of the best of these is that of Szymanowski.\* This operation is performed in the following manner: When the fistula lies in the long axis of the penis a straight incision is to be first made, beginning just in front of the fistula and terminating a short distance behind it. The integument upon one side is then to be dissected up so as to be freely movable. A half oval flap of skin on the other side of the fistula is then outlined and dissected up, excepting at the edge of the fistula, its epidermis being first removed. The dissected flap is then to be inverted and pushed under the skin which has been freed upon the opposite side, as into a pocket. It is then to be retained in position by sutures passed into and through the bottom of the pocket. The movable skin is then slid over it and also stitched. An elastic catheter is to be passed into the bladder and there retained. This operation has been practiced and highly recommended, especially by such excellent operators as Drs. Charles McBurney, Robert F. Weir,† E. L. Keyes and T. T. Sabine. I have employed the method in two cases with most gratifying success.

\*Hand-book of Operative Surgery, 1870.

†Medical Record, April 13, 1878.

Dr. McBurney\* has practiced a modification of the operation in a number of cases with great success. In a report of six cases this gentleman speaks as follows:

"One case, the first, owing to imperfect management, failed completely. Five cases succeeded, and in none of them was any second operation required.

The second case required three months and six days to obtain sound healing; the third, seventeen days; the fourth, thirteen days; the fifth, nineteen days; and the sixth, thirty-four days. No symptom of the slightest importance occurred in any of the last five cases, and the length of time occupied in recovery certainly compares very favorably with that often spent in futile and even successful attempts to close perineal fistula without operation.

The plan adopted in all of these cases was as follows; and, if the description seems tedious, my excuse must be that I believe the success of the operation to depend largely upon a close attention to details:

Some time previous to operation the entire urethra was cleared of all evidence of stricture, and the urethra accustomed to the passage of sounds; any sinuses in the neighborhood of the fistula were opened and soundly healed. If cystitis existed, it was removed as far as possible, although a moderate amount of chronic cystitis certainly does not contra-indicate the operation.

The day before operation the bowels and rectum were thoroughly cleared in order, especially, that for several days afterward the rectum and adjacent parts might be kept perfectly quiet by a free use of opium. The perinæum was then shaved and carefully cleansed, and the bladder emptied with the catheter and thoroughly washed out with a weak solution of either borax or carbolic acid. The edges of the fistula were then either scraped or cut so as to remove all suppu-

\* New York Med. Jour., November 6, 1886.

rating granulations which would naturally increase discharge and prevent early union.

A single straight incision was then made, from A, three quarters of an inch in front of, to B, three quarters of an inch behind, the fistula (Fig. 74). This incision passed through skin and superficial fascia, and closely skirted the right side of the fistula. The edge of this incision was raised and, working with a small blade to the patient's right side, the skin and fascia were undermined until a pocket was formed including the area A C B F, the right edge of the pocket being indicated by the dotted line A C B.

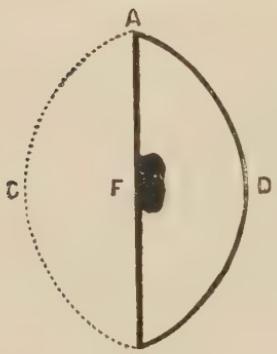


Fig. 74.

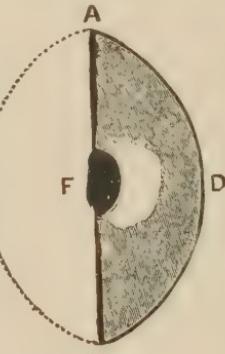


Fig. 75.

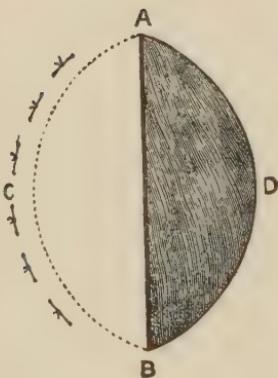


Fig. 76.

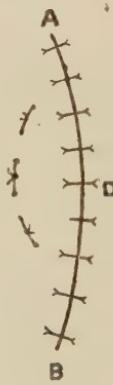


Fig. 77.

On the opposite side, a curved incision A D B was then made, the greatest width of the flap thus marked out being three quarters of an inch to one inch.

This flap must be generous and should include a good padding of fascia as, when it is lifted, the shrinkage is great.

Before lifting the flap a thin layer of skin was removed from its surface. This is best done with small curved scissors, the superficial layer of skin being rapidly chipped off.

The freshening process was carefully extended over the entire area A D B F, excepting over a surface a little larger than the fistula, and immediately next to it.

It was thought best to leave this portion undenuded for the immediate cover to the fistula, because less cicatricial repair would occur, and less pus would be formed than if a raw surface were presented to the urethra (see Fig. 75.) The flap A D B was then dissected up close to the median line and inverted, its attached edge acting as a hinge and as a medium for blood supply.

Five or six fine catgut sutures were passed through the skin at different points a little beyond the dotted line, A C B, into the pocket, then through the free edge of the flap, and then back into the pocket and out through the skin. Five or six loops were thus formed, by drawing upon which the flap was closely drawn down to the bottom of the pocket, and the free ends of the loops were tied.\* (See Fig. 76.) Two or three sutures of catgut were now passed with a curved needle through the upper surface of the inverted flap so as to firmly bind it to the parts beneath. Sometimes with interrupted and sometimes with a continuous catgut suture the free edge, A F B, was now securely fastened to the edge, A D B.† (See Fig. 77.) Irrigation with carbolic acid or bichloride solution was used throughout, excepting in the first case.

The dressing consisted of iodoform, iodoform gauze, and a cotton pad, held in place with a T-bandage.

\*In the first two cases silk was used, and, I think, interfered with healing.—(McBurney.)

†The line of suture was thus removed to a distance from the fistula, *large raw surfaces* were brought in contact, and two thick layers covered the fistula. —(McBurney.)

A morphine suppository was usually introduced before the dressing.

The subsequent treatment consisted in a free use of opium to prevent the rectum from acting, and the use of the soft catheter, the latter at least every six hours and as much oftener as was required. Sometimes the catheter would be required as frequently as every three hours, and sometimes it caused moderate urethritis.

The catheter was always, excepting in the first case, thus used: It was introduced and the water drawn off. The bladder was then gently washed out with a weak solution of either carbolic acid or borax; I prefer the latter. On withdrawing the instrument the end was tightly pinched until the whole catheter had been removed from the urethra. This plan seemed to reduce the chance of contaminating the wound with urine from the inside to a minimum, and is certainly much to be preferred to the practice recommended by Szymanowski of tying in a catheter, or that made use of by me in my first case of puncturing the bladder through the rectum."

NELATON'S OPERATION has been somewhat popular. It is performed in the following manner. The edges of the fistula should first be freely pared; the surrounding skin for an area of about an inch in breadth and extending a little beyond the fistula anteriorly or posteriorly should then be dissected subcutaneously by a narrow bladed knife introduced posterior to the fistula. The raw edges of the latter are then brought together by fine sutures.

Another method is proposed by the same surgeon. The edges of the fistula are first pared and the skin separated for about half an inch upon each side of the opening. Lateral incisions are then to be made at a distance of about half an inch from the pared edges of

the fistula, for the purpose of relieving tension. A slip of thin India rubber tissue may then be passed underneath the flaps of skin in order to prevent contact of urine with the raw edges and consequent disturbance of adhesion. Should the fistulous opening close, the lateral incisions very promptly heal. In both of these operations the extensive separation of the skin causes abundant granulations to spring up with the result of closing the fistula.

In cases of extensive fistulæ of the penile urethra perineal drainage may be established after a plastic operation has been performed.

Ricord recommended for cases in which perineal or scrotal fistulæ co-exist with fistulæ in the pendulous urethra that a catheter be passed

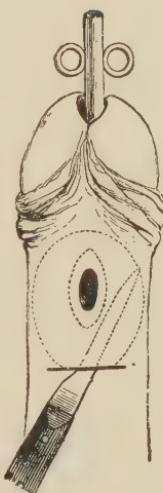


Fig. 78.  
Nelaton's Operation for  
Penile Fistula.

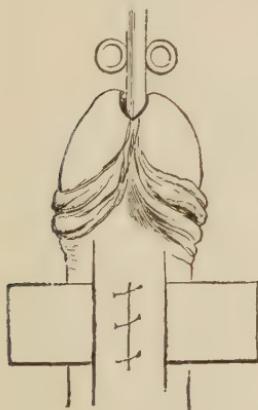


Fig. 79.  
Nelaton's Operation for Penile  
Fistula.

through the lower fistula for the purpose of draining the bladder during the treatment of the penile lesion. He also suggested puncturing the bladder. Erichsen recommends that this be done through the rectum, but the Harrison method of perineal drainage is far better. The opening made in the perineum by this latter operation will almost invariably close spontaneously when it has subserved its function.

*An operation for extensive penile fistula was recommended by Le Gros Clark. This is performed as follows: The edges of the fistula hav-*

ing been thoroughly pared, a transverse cut about an inch in length is made through the integumentary coverings of the penis a little distance in front of the fistula. (a) Two transverse incisions are then made at the peno-scrotal angle, each being about an inch and a half in length. These transverse incisions are connected at each end of the fistula by a short longitudinal incision. (b) The flaps of skin thus outlined are dissected up and brought together by means of clamps or the quilled suture. By this procedure

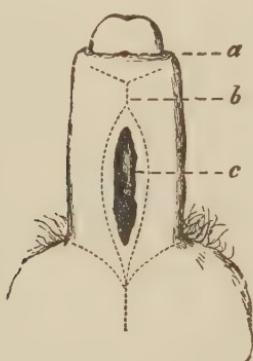


Fig. 80.  
Clark's Operation for Penile  
Fistula—First Step.

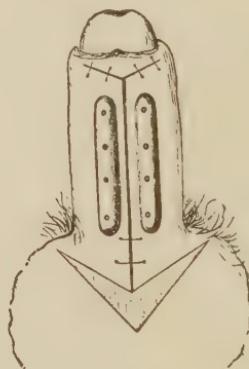


Fig. 81.  
Clark's Operation for Penile  
Fistula—Second Step.

two broad raw surfaces (at *c*) are brought together instead of a narrow raw edge of skin, and there is therefore a much better prospect of successful union.

*Stone in the Bladder* complicating stricture is occasionally seen. The calculus under such circumstances may be of renal or vesical formation. In the first instance a small uric acid or oxalate of lime calculus comes down from the kidney and lodges in the bladder, and forms in the ordinary manner a nucleus for a calculus of variable size. In the second instance, as a consequence of secondary vesical disease with co-incident decomposition of urine, a phosphatic calculus forms

in the *bas fond*. In cases in which calculus co-exists with a slight stricture that is susceptible of treatment by dilatation or urethrotomy, the stricture should be treated in the ordinary manner, measures being at the same time carried out which will tend to keep the bladder in as healthy a condition as possible, until such time as it is practicable to operate upon the stone by litholapaxy, or if the stone be too large for this operation, by lithotomy. In cases of hard and indurated stricture of the deep urethra with vesical calculus as a complication, perineal section may be performed and the calculus removed as in the ordinary median operation for stone, or the median operation and lithotripsy may be combined, if the stone be too large to be extracted with a forceps. It is advisable to avoid the lateral operation if it is possible to do so. In cases of very large stone complicating organic stricture—the latter requiring perineal section—it is my opinion that supra-pubic lithotomy is the most rational mode of operation.

## PROSTATIC HYPERSTROPHY.

*Enlarged Prostate* as a complication of stricture is very exceptionally seen, for the reason that stricture has usually manifested itself and has demanded and received attention prior to the period of life at which enlargement of the prostate is likely to first cause annoyance. Even when stricture and enlarged prostate co-exist the latter is not apt to prove a serious complication, unless the tumor which it forms is very large and interferes with the passage of instruments beyond the bulbo-membranous junction. Stricture in the penile portion of the canal should be treated upon the same principles as though enlarged prostate did not exist. In cases of deep and tight stricture, continuous dilatation should be practiced until an instrument of moderate size can be passed. Steel instru-

ments of the proper prostatic curve should now be used for dilatation. If the stricture be very tight and hard, and retention exists, external perineal urethrotomy should be performed. There is one compensating advantage in the necessity of this operation which is, that in case circumscribed portions of the enlarged prostate should be found to constitute the principal obstruction at the mouth of the bladder, they may be removed at the same operation.

I have recently had a trying experience with a case of retention in a man of 60, who also had a stricture of the deep urethra. Fortunately the stricture was not very tight and yielded in a few days, retention being meanwhile relieved by the aspirator. As soon as instruments could be passed, continuous dilatation was practised for a few days. Gradual dilatation by soft flexible bougies was then substituted and the urethra moderately dilated. The case was lost sight of before it could be conducted to a cure, as far as the stricture was concerned, but when last heard from the patient was in a very comfortable condition, and considered it unnecessary to submit to further treatment.

*Inflammation of the Seminal Vesicles:* It has recently been shown by Mr. Jordan Lloyd and others, that the seminal vesicles are not infrequently involved in gonorrhreal inflammation. Those who have studied the subject are particularly impressed with the analogy of pathological processes occurring in the seminal vesicles and those of the Fallopian tubes. There seems to be no question that in old cases of stricture and chronic urethritis, the seminal vesicles may be the seat of chronic pathological changes. Mr. Lloyd's conclusions are as follows:

1. It is not a rare affection.
2. It is analogous to diseases of the Fallopian tubes.

3. It is usually secondary to urethritis.
4. The vesiculæ seminales become distended by obstruction.
5. Suppuration is unusual, but may occur.
6. Such abscesses should be opened from the perineum, never from the rectum.
7. *Gonorrhœa is by far the most common origin.*
8. It is often diagnosed as prostatitis.
9. It is often concomitant with gonorrhœal epididymitis.
10. The diagnosis is best made by rectal exploration.

*Cystitis.*—Inflammation of the bladder is a frequent complication of stricture of the urethra. It varies in severity from the so-called inflammation of the vesical neck, to the severe and intractable form of chronic inflammation met with in some severe and long-standing strictures.

A lengthy discussion of cystitis and its treatment would be out of place in a work of this kind, but a few practical points are essential to completeness.

Inflammation of the vesical neck—more properly described as posterior urethritis—is a very frequent result of stricture. It may be acute or chronic, and results in one of two ways—or in a combination of the two—viz.: extension of the primary gonorrhœal inflammation to the prostatic sinus, where it becomes chronic, or by gradual infection of the deep urethra from the infectious process behind the stricture. Oftentimes a dirty instrument is responsible for infection of the deep urethra. The relation of the instrument is occasionally only that of a carrier of poison from the anterior urethra—or from that portion of the canal which is affected by the stricture—into the deeper parts. In some instances the instrument lights up traumatic inflammation of the

strictured portion of the canal, which extends by contiguity to the vesical neck.

One of the most important elements in the production of posterior urethritis, is the reflex irritation, congestion and spasm of the muscular urethra and vesical neck, induced by the stricture. This will result in stricture of large calibre in the penile portion as readily as in stricture of the deeper portion. The indication in any case of cystitis complicating stricture, is to remove the cause. It is well to remember however, that acute cystitis occurring in the course of stricture must be handled with some circumspection. It is generally well to allow the acute inflammation to subside somewhat, before tampering with the stricture. Oftentimes cystitis persists after removal of the stricture which caused it, and it may require prolonged and careful treatment for its subjugation.

Cystitis of the vesical neck—*i.e.*, posterior urethritis—may often be nipped in the bud by an injection of a five or ten grain solution of the nitrate of silver *via* the Ultzmann deep urethral syringe.

It is probable that certain changes occurring in the bladder as a result of the sudden relief of prolonged retention, have much to do with the occurrence of cystitis in stricture. Heubner has performed some very interesting experiments tending to show the important relation of sudden circulatory fluctuations to cystitis. One of his most striking experiments consisted of the ligation of the vesical artery for two hours. The temporary ligature being removed at the end of this time, it was found that coincidentally with the restoration of the circulation there occurred extensive exudation and coagulation necrosis of the vesical walls. This experimenter also found that if septic bacteria were introduced at the same time the circulation was restored, they accumulated in great numbers at the site of the

pathological changes mentioned. Cornil produced septic nephritis by ligating the renal artery for some hours, then removing the ligature and injecting pyogenic organisms into the blood. It would seem then that the local innutrition produced by temporary anaemia of the bladder and kidney structure predisposes to the morbid action of pathogenic bacteria under the local disturbance produced by sudden restoration of the circulation. The facts above cited have a much more important bearing upon cystitis following prolonged retention from enlarged prostate, but it is at least fair to assume that they are pertinent to certain cases of cystitis in stricture.

*Pyelitis* in stricture is in nowise different from that which occurs in other inflammatory and obstructive conditions of the genito-urinary tract. A full presentation of the subject is hardly in keeping with the scope of this work. Pyelitis from stricture varies in degree from a slight catarrhal inflammation, to severe and intractable inflammation with a profuse formation of pus. The disease is so constant an ingraft upon stricture, that a greater or less degree of pyelitis is to be inferred in all long-standing and severe strictures. Pyelitis may persist and steadily grow worse in spite of the removal of the original cause. In some cases a severe degree of pyelitis is present—judging from the amount of pus present in the urine—yet the patient appears to tolerate the difficulty without much disturbance resulting. One of the chief dangers of stricture is a sudden exacerbation of pyelitis, the resulting inflammation—pyelonephritis—involving the kidney structure proper.

*Epididymitis* is often met with in stricture, and occurs repeatedly in some patients throughout the course of treatment. It may result from infection by materials formed behind the stricture—the products of

bacterial evolution—or it may be due to a sudden exacerbation of inflammation in and about the stricture brought on by instrumentation, dietary indiscretions, sexual excitement or over exertion. Epididymitis in stricture may be acute, subacute or chronic. Often-times the process is subacute and results in the formation of a small, hard, tender nodule in the globus major. In tubercular patients, very serious results may ensue. The principal point to be borne in mind is that stricture of the urethra is a constant invitation to inflammation of the epididymis, which may be avoided by the use of a properly fitting suspensory, and avoidance of all sources of sexual excitement, over-exertion and indulgence in liquors or high living. Care in instrumental manipulations is a still more important prophylactic measure. The importance of avoiding epididymitis, as a menace to fertility, is at once manifest, but in my opinion receives too little consideration at the hands of the surgeon. *Impotentia generandi* is not an extraordinarily rare result of stricture, and a very small nodule in each epididymis may be all sufficient to produce it.

*Impotence.* True or false impotence may result from stricture. One of the most frequent effects of stricture is a reflex inhibition of the erectile power—perhaps dependent on disturbance of the nerves of sexual sensibility in the prostatic sinus. It is obvious that the disturbance may be due to a direct impression upon the deep urethra. In many instances the impotence associated with stricture is altogether due to mental disturbance incidental to the knowledge of the presence of the stricture. *Impotentia cocundi* may be due to a chronic chordee produced by the stricture. In such cases the neoplastic formation produces pressure obstruction of the blood vessels and also by its inelasticity causes an incurvation of the penis at the affected point.

*Impotentia generandi* may exist, copulation being satisfactorily performed, but true sterility existing. This is due to mechanical obstruction to the passage of the semen.

Impotence and sterility usually disappear on removal of the stricture. In some cases, however, *impotentia coeundi* of mental origin will remain after cure of the stricture, and will require careful management.

Imperfect erection is a not infrequent sequel of stricture under any method of treatment, and may be a permanent source of disquiet. This most often occurs after urethrotomy.



## INDEX.

	PAGE.
Anatomy of the Urethra.....	3
Antisepsis and Asepsis in Urethral Surgery.....	31
Annular Stricture.....	78
Antisept.cs, Internal Administration of in Stricture.....	136
Antispasmodics, use of, in Stricture.....	137
Arnaud and Butte, Neuopathic Albuminuria.....	187
Antogenesis, Relation of to Urinary Toxaemia.....	190
Atter treatment in Urethrotomy.....	227
Aspirator, use of, in Retention of Urine.....	281
Abscess, Peri-urethral, as a Complication of Stricture.....	304
Buck's Fascia.....	18
Buck's Fascia, Illustration of.....	19
Buck's Fascia, Cavity Formed by.....	20
Benique, Sound of .....	30, 169
Bladder, Pathological Changes in, from Stricture.....	106
Bladder, Rupture of, from Retention.....	301
Bougie a Boule, Diagnostic Value of.....	121
Banks (E. A.), Whalebone Bougie.....	167
Brodie (Sir Wm.), Catgut Bougies.....	167
Bougies, Whalebone.....	167
Bougies, Olivary .....	168
Brown (W. T.), Urethral Speculum.....	177
Bryant, Case of Multiple Urinary Fistula.....	307
Caput Gallinaginis.....	13
Cowper, Glands of .....	16
Care of Urethral Instruments.....	33
Congestive Stricture.....	50, 70
Cruevilhier, cut off Muscle of .....	21
Chronic Spasmodic Stricture.....	58
Conformation of Instruments.....	29
Congenital Stricture .....	74
Causes of Organic Stricture.....	110
Chancre and Chancroid, Causation of Stricture by .....	111
Caustics, use of in Stricture.....	138
Continuous Dilatation.....	170
Chronic Uraemic in genito-urinary Disease.....	204
Civiale, Urethrotome of .....	219
Civiale, Case of Extensive Multiple Urinary Fistula.....	306
Curvature of Penis Following Urethrotomy .....	225
Complications of Stricture.....	276
Cock's Operation of Perineal Cystotomy .....	285
Chiene, Siphon Drainage for the Cure of Urinary Fistula .....	310
Cooper (Sir Astley), Nitric Acid in Urinary Fistula.....	312
Cantharides, use of in Urinary Fistula.....	312
Clark (Le Gros), Operation for Extensive Penile Fistula .....	319
Cut Off Muscle.....	21
Cut Off Muscle, Spasm of .....	22
Curve of Urethra.....	29
Cystitis, Complicatory Stricture.....	323

Deep Fascia of Perineum.....	22
Definition of Stricture.....	48
Degrees of Contraction in Stricture.....	82
Desnos (M.), Relation of Slight Traumatism to Stricture.....	93
Density of Stricture .....	109
Diagnosis of Stricture.....	119
Deep Urethra, Stricture of.....	152
Dilatation, Untoward Effects of.....	180
Divulsion, Operation of .....	213
Divulsion, Indications for use of.....	216
Dieffenbach, use of Cantharides in Urinary Fistula.....	312
Erectile Tissue of Penis.....	17
Elasticity of the Urethra.....	94
Elasticity of the Urethra, Impairment of .....	94
Exploration of Urethra by Bulbs.....	126
Eucalyptus, use of in Stricture.....	136
Endoscopy, Instruments for.....	177
Endoscopy, Technique of .....	177
Edes (R. W.), Nervous Lesions as a Cause of Albuminuria.....	189
Engleman (Geo. J.), Renal Disturbance from Reflex Action.....	189
Erichsen (J. E.), Urethral Chill in Female .....	202
Erichsen (J. E.), Case of Perineal Section.....	250
Eldridge (Stuart), Case Showing Permanent Results of Urethrotomy.....	238
External Urethrotomy.....	245
Electrolysis of Stricture.....	261
Fossa Navicularis.....	10
Fossa Navicularis, Section of .....	11
Fascia of Perineum.....	18
Form of Metallic Instruments.....	37
Female, Urethral Stricture in.....	73
Friction, Relation of to Stricture.....	97
Finger (E.), Injection of Deep Urethra.....	178
False Passages from Dilatation.....	207
False Passages, Symptoms of.....	208
False Passages as a Complication of Stricture .....	276
Fort (J. A.), Linear Electrolysis.....	270
Forcible Instrumentation.....	276
Forcible Catheterization in Retention .....	284
Fistula from Stricture.....	306
Fistula, Treatment of.....	309
Glands of the Urethra.....	14
Gleet, Association of with Penile Stricture .....	142
Gleet, Various Causes of.....	148
Gouley (J. W. S.), Whalebone Guides.....	166
Gouley (J. W. S.), Rapid Dilator.....	215
Gouley (J. W. S.), Dilating Urethrotome.....	218
Gradual Dilatation.....	172
Granular Urethritis.....	179
Guyon (F.), Bougie a Boule .....	122
Heredity, in the Etiology of Stricture.....	212
Harrison (R.), Remarks on Urine Fever .....	181
Harrison (R.), Combined Method of Urethrotomy.....	248
Holbrook, Nerve Terminations in the Kidneys.....	188
Haemorrhage from Dilatation.....	206
Holt, Divulsor for Stricture.....	.....
Hypertrophy of the Prostate as a Complication of Stricture .....	321
Instrumentation of the Urethra.....	30
Instrumentation of the Urethra, Method of .....	39

Instruments, Care of.....	30
Instruments, Lubrication of.....	34
Inflammatory Stricture.....	50, 70
Inflammatory Stricture, Causes of.....	70
Inflammatory Stricture, Treatment of.....	71
Irregular Stricture, Illustration of.....	78
Injections, Causation of Stricture by.....	112
Inflammation of the Bladder from Dilatation.....	211
Inflammation of the Testicles from Dilatation.....	211
Inflammation of the Prostate from Dilatation.....	210
Internal Urethrotomy.....	217
Infiltration of Urine.....	286
Infiltration of Urine, Direction Taken by.....	287, 299
Infiltration of Urine, Effects of.....	290
Infiltration of Urine, Treatment of.....	302
Impotence from Stricture.....	325
Klotz (H. G.), Endoscope.....	177
Keyes (E. L.), Discussion and Experiments on Urinary Extravasation.....	291
Keyes (E. L.), Direction of Urinary Extravasation.....	299
Littre, Glands of.....	14
Lacuna Magna.....	15
Lubricants for Instruments.....	34
Linear Stricture.....	76
Location of Stricture.....	89
Long (J. W.), Remarks on Reflex Renal Disturbance.....	186
Linear Electrolysis .....	270
Meatus Urinarius.....	6
Membranous[Urethra.....	11
Membranous]Urethra, Structure of.....	12
Morgagni, Sinuses of.....	14
Morbid Anatomy of Stricture.....	102
Morris (H.), Case Showing Extreme Results of Stricture.....	107
Meatatomie of Civiale.....	123
Meatatome of Piffard.....	123
Meatotomy.....	123
Meatotomy, Dilatation After.....	125
Morphia, use of in Stricture.....	137
Methods of Treatment, Selection of.....	137
Meatal Stricture, Treatment of.....	139
Meatoscope .....	177
Medication of Deep Urethra.....	178
Maisonneuve, Urethrotome of.....	218
Mastin (C. H.), Subcutaneous Division of Stricture.....	254
McBurney (Chas. F.), Urethroplasty.....	315
Neurosis in Stricture.....	116
Nervous Manifestations from Urethral Operations.....	200
Newman (R.), Electrolysis of Stricture .....	263
Nitric Acid, Use of in Urinary Fistula.....	312
Nelaton, Operation for Urinary Fistula.....	318
Nelaton, Operation for Urinary Fistula, illustration of.....	319
Operation of Sounding... .....	41
Organic Stricture.....	72
Organic Stricture, Varieties of.....	76
Organic Stricture, Number of.....	80
Otis, (F. N.) Remarks on Urethritis.....	58
" " Multiple Stricture, Case of.....	81
" " Views on the Location of Stricture.....	84
" " On Urethal Friction in its Relation to Stricture.....	99

Otis, (F. N.) Urethrometer.....	120
"    "    Bulb Sounds.....	121
"    "    Scale of Measurement of Urethra.....	122
"    "    Remarks on Relation of Gleet to Penile Stricture.....	142
"    "    Endoscopic Tube.....	177
"    "    Dilating Urethrotome.....	219
"    "    Curved Urethrotome.....	220
"    "    Diagona'.....	225
"    "    Measurement of Penis and Urethra prior to Operation.....	222
Olivary Bougies.....	168
Operative Treatment of Stricture.....	213
Penis. Sections of.....	10
Prostatic Urethra.....	12
"    "    Section of.....	13
"    "    Sinus.....	14
"    "    Follicles.....	14
"    "    Immunity of from Stricture.....	89
Perineum, Superficial Fascia of.....	18
"    "    Deep Fascia of.....	22
"    "    Diagrammatic Section of .....	23
"    "    Vertical Section of .....	25
Plus Conditions of Stricture.....	50
Pathological Localization of Stricture.....	90
Piffard (H. G.) Meatometer.....	123
Piffard (H. G.) Meatatome.....	123
Prognosis of Stricture.....	128
Penile Stricture, Prognosis of.....	149
Peyrani, Effect of Section of Sympathetic Nerves on Renal Section.....	186
Palmer (E. R.) Boric Acid as a Urinary Antiseptic.....	198
Prostate, Inflammation of, from Dilatation.....	210
Prostate. Hypertrophy of, Complicating Stricture.....	321
Penis, Curvature of, Following Urethrotomy.....	225
Permanency of Result of Urethrotomy.....	229
Perineal Section.....	245
Perineal Section with a Guide.....	246
Perineal Section without a Guide.....	249
Perineal Fistulae.....	312
Prince (David) Method of Electrolysis.....	264
Puncture of the Bladder per rectum.....	282
Puncture of the Bladder above the pubes.....	284
Peri-urethral Suppuration.....	304
Peri-urethral Suppuration, Treatment of.....	306
Pyelitis from Stricture.....	324
Rifling of the Urethra.....	17
Resilient Stricture.....	157
Recurrent Stricture.....	157
Renal Disease, Relation of, to Urinary Fever.....	185
Remote results of Urethrotomy.....	229
Retention of Urine.....	278
Retention of Urine, Treatment of.....	280
Rupture of Bladder.....	301
Recto-urethral Fistula .....	311
Spongy Urethra.....	8
Sinus Pocularis.....	14
Sinuses of Morgagni.....	14
Spasm of Cut-off Muscle.....	22
Selection of Instruments.....	35
Size of Instruments.....	35

Scaling of Instruments.....	37
Scale Plates.....	38
Stricture, Definition of.....	48
" Varieties of.....	48
" Causes of.....	48
" Conditions Producing.....	48
" Spasmodic.....	50-66-69
" Spasmodic, Relation of to Cut-off Muscle.....	51
" Congestive.....	50-70
" Inflammatory.....	50-70-71
Smith (H.) Location of Stricture.....	84
Sands (H. B.) Casts of Normal Urethra.....	94
Summary of Treatment of Stricture.....	162
Systematic Dilatation of Stricture.....	165
Sudden Death During Operation upon Urethra.....	192
Syme, Operation of Per neal Section.....	246
Subcutaneous Division of Stricture.....	254
Supra-pubic Puncture.....	284
Seminal Vesicles, Inflammation of, Complicating Stricture.....	322
Scrotal Fistulae.....	312
Szymanowski Operation for Urethral Fistula.....	318
Szymanowski Operation for Urethral Fistula, Illustration of.....	316
Stone in the Bladder as a Complication of Stricture.....	320
Triangular Ligament.....	22
Triangular Ligament, Illustration of.....	22
Triangular Ligament, Contents of.....	22
Thompson (Sir. H.) Normal Urethral Curve.....	28
" " On the Location of Stricture.....	84
" " Heredity in Stricture.....	112
" " Divulsor for Stricture.....	214
" " Cure of Recto-Urethral Fistula by Position.....	311
Transverso-Urethral Muscle.....	21
Tortuous Stricture.....	79
Toxaemia from Stricture.....	118
Treatment of Stricture.....	135
Treatment of Stricture, Summary of.....	162
Treatment of Meatus.....	139
Treatment of Penile Stricture.....	140
Tortuous Complicated Stricture.....	
Urethra, Anatomy of.....	3
" Functions of.....	3
" Length of.....	4
" Curves of.....	4-27
" Variation in Length of.....	4
" Vertical Section of.....	5
" Divisions of.....	6
" Spongy Portion of.....	8
" Bulb of.....	8
" Section Through Spongy Portion of.....	9
" Membranous Portion of.....	11
" Glands of.....	14
" Instrumentation of.....	30
" Stricture of.....	16
" Rifling of.....	17
" Muscles of.....	20
Uterus Masculinus.....	14
Urethrismus.....	58
Untoward Effects of Dilatation.....	180
Urethral Fever.....	180-

Urethral Fever, Forms of.....	182
Urethrotome, Varieties of.....	218
"    Gouley's.....	218
"    Maisonneuve's.....	218
"    Civiale's.....	219
"    Otis'.....	219
"    Otis' Curved.....	220
"    Otis' Diagonal.....	225
Urethrotomy, Internal, Operation of.....	221
"    Untoward Effects of.....	225
"    Curvature of Penis from.....	225
"    After Treatment in.....	227
"    Permanency of Result of.....	229
"    Remote Effects of.....	229
"    Personal Experience in.....	230
"    Cases Showing Permanency of Results.....	231
"    External.....	245
"    Subcutaneous.....	254
Urine, Retention of.....	278
Urine, Infiltration of.....	286
Urinary Fistula.....	306
Urinary Fistula, Treatment of.....	309
Urethroplasty.....	312
Veru montanum.....	13
Veru montanum, Paralysis of.....	13
Varieties of Stricture.....	48
Varieties of Organic Stricture.....	76
Van Buren (Wm. H.), Sound of.....	169
Weiss (F. D.) Bougie a Boule.....	122
Weir (R. H.) Meatoscope.....	177
Weir (R. H.) Renal Disturbance Following Gastro-Enterotomy.....	189
Wheelhouse, Operation of Perineal Section.....	252

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